XgOS

User's Guide

VIRTUAL
NETWORKING

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Using This Documentation

This document provides information about the XgOS CLI and on upgrading XgOS for the Oracle Fabric Interconnect.

- "Related Documentation" on page xxv
- "Feedback" on page xxv
- "Support and Accessibility" on page xxvi

Related Documentation

Documentation	Link
All Oracle products	http://www.oracle.com/documentation
Oracle Virtual Networking Documentation	http://www.oracle.com/goto/FABRIC-INTERCONNECT/docs

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CHAPTER 1

XgOS CLI Overview

The XgOS command-line interface (CLI) includes commands to configure every aspect of the Oracle Fabric Interconnects F1-15 and F1-4. This chapter introduces the XgOS CLI and the categories of objects it configures. It contains the following major sections:

- "Command Syntax Conventions" on page 2
- "Entering Commands and Getting Help" on page 2
- "Logging in to the Oracle Fabric Interconnect" on page 9
- "Virtual Resources Quick Start" on page 9

For more detailed information about these topics, see the following:

- Specifying chassis hardware elements, see "Configuring Hardware Elements" on page 17.
- Understanding the XgOS file system, see "XgOS File System Access and Logging" on page 45.
- Scripting repetitive tasks, see "Scripting XgOS Commands" on page 351.
- Configuring the CLI, see "Configuring the XgOS CLI" on page 53.

Command Syntax Conventions

Convention	Description	Examples
courier bold	Commands and keywords that must be entered exactly as shown. It also highlights significant lines in the screen output display.	**show vnic**
courier plain	Actual display output that has been copied from the device. Also used for variable names shown in command syntax.	resourceUnavailable
" "	Quotes reference specific fields taken from the screen display on the device.	See the "state" field.
< >	Angle brackets indicate variables for user input. Replace the angle brackets and variable name with information that is indicative of your setup.	**add vnic** <vnic-name>**.**<server-profile> <slot>**/**<port>
{}	Curly braces indicate a choice of required keywords or variables. You must enter at least one of the enclosed parameters.	**set vnic** {*****|<vnic-name>}
[ ]	Square brackets indicate a choice of optional keywords or variables.	**show system version** [**-all**]
|	A pipe operator indicates a choice. You can enter one of the parameters on either side of the pipe.	**set vnic** {*****|<vnic-name>}

Entering Commands and Getting Help

The command-line interface (CLI) enables you to access the following elements:

- Virtual Resources—The virtual NICs, virtual HBAs, and other items involved in providing virtual I/O for your systems. For an introduction to configuring virtual I/O, see "Virtual Resources Quick Start" on page 9.
- File System—A file storage system. See "XgOS File System Access and Logging" on page 45.
- Hardware—Servers, I/O cards, and system logs. For the details about referring to these on the command line, see "Configuring Hardware Elements" on page 17.

- Scripting Engine—Enables you to run scripts within the CLI for each I/O card. The engine also enables you to define new commands. Script support in the XgOS CLI includes a full text editor for writing and revising your scripts. For the details about the scripting engine, see "Scripting XgOS Commands" on page 351

This section introduces the CLI itself and explains the online help that is available.

Command Completion

The CLI includes a powerful command-completion feature that informs you of possible commands, subcommands, and options at each point on the command line. The following kinds of command completion are available:

- To complete an unambiguous entry, press the Tab key.
- If your entry is unambiguous, the CLI completes the command or subcommand that you have begun typing. For example, if you enter the following:

```
add server-[Tab]
```

  the CLI adds `profile` to your command line as the only legitimate completion. This form of command completion can potentially save you a lot of typing.

- To see valid completions at any point, type **?** on the command line.
- Typing a question mark causes the CLI to print a list of valid completions, and some short help text for each item, for what is currently on the command line. For example, if you enter the following:

```
ad?
```

  The CLI responds with the following:

```
Possible completions:
  [Configuration commands]
    add     Add a configuration object to the system if it doesn't already exist.
  [Scripts]
    add10vnics
```

- You can also press the Tab key twice to get this same command completion.

The command-completion facility is context sensitive and always displays what the CLI determines to be valid at the point in the command where you request the completion. You can configure the CLI to automatically complete the command whenever the space bar is pressed. (Refer to the `set cli space-completion` command.)

For example, to get command-completion hints and context-sensitive help about adding a vNIC:

```
add vnic ?
Possible completions:
  <name>  Virtual NIC name
Repeat '?' for detailed help.
```

Online Help

In addition to command completion, the CLI includes online help topics at various levels. To access these topics enter `help <command>`. The CLI displays the detailed help topic for that item, if such a topic is available.

Certain higher-level concepts also have help topics within the CLI. Enter help <TopicName> to see these help items. Topics in the CLI online help include:

- Getting-started: Information about getting started with the system
- Scripts: Information about the use of scripts
- Concepts: High-level concepts describing the OVN system
- High Availability: High availability features
- VLANS: Virtual LAN features
- QoS: Quality of Service features
- Aikido: Information on the Aikido programming language used by the CLI for scripting facilities
- Roles: Xsigo's Role Based Access Control mechanism
- Phone-Home: the command for Xsigo ProWatch facility for remote diagnostics

For example, to view the help topic about adding vNICs:

```
help add vnic
Add a new virtual Network Interface Card (vNIC) to the system. You must provide
a hierarchical name for the vNIC at the time that it is added. A 'hierarchical'
name includes the name of the vNIC, plus the name of the server profile to which
the vNIC is assigned. The two names are separated by the dot '.' character. For
example: 'add vnic <vNIC_name>.<server_profile_name>'.

A second (optional) parameter of the 'add' command specifies the termination for
the vNIC. A vNIC can be terminated on an I/O port. For example:
'add vnic <vNIC_name>.<server_profile_name> slot/port'.
```

Editing Commands on the Command Line

While entering a command, you can move around in the command-line text and edit it. The following list shows the control key strokes that are available:

- Left and right arrow keys: Move the cursor to either the left or to the right on the command line.
- Up and down arrow keys: Scroll up and down in the command history.
- Ctrl-L: Retype the line
- Ctrl-U: Erase the line
- Ctrl-C: Quit the command
- Ctrl-R: Search the command history.
- Ctrl-E: Move to the end of the command
- Ctrl-A: Move to the beginning of the command

Command History

The CLI maintains a history of the commands that you have entered, over multiple sessions. Use the up and down arrows to scroll through the command history and find a specific command. When you find the desired command, press the carriage return on the keyboard to execute that command.

You can also search the command history for a sequence of characters using Ctrl-R. As you type characters after Ctrl-R, the CLI searches backwards through the command history for commands containing those characters. To select a command found this way, press the carriage return. Alternatively, use Ctrl-R again to continue the search.

Redirecting Output

You can redirect the output from any command may be redirected to a file by placing a '>' sign followed by a filename, at the end of the command. For example, entering the following will run the command, and place the output in a file called `allvnics` in the current directory:

```
show vnics > allvnics
```

Another way to redirect the command output is to execute the command inside backtick characters and then place the result in a variable. For example, if you enter:

```
var vnics = ‘show -list vnics’
```

The variable `vnics` contains a vector of lines containing the output from the `show -list vnics` command.

Wildcards

You can use wildcards to control the display of output. Wildcards may be used in most of the XgOS `show` commands to select a set of objects. The only wildcard character supported is the asterisk (*) which causes zero or more of any character to be displayed in the `show` command. Wildcards can also represent entire names.

Strings you create with wildcards are case sensitive, so make sure you enter the wilcarded item correctly. For example, vNICs named “vnic1” and “vnic2” are not displayed if you issue `show vnic V*`. If you issue show vnic v* the vNICs are displayed.

Note – Not all `show` commands support the use of wildcards (for example, LAGs and VLANs do not support them for selecting the LAG name or VLAN number)

For example, if you enter:

```
show vnic v*
```

The wildcard character represents zero or more characters in a name string starting with “v.” The result of this command is a list of all vNIC with “v” as the first letter.

If you enter:

```
show vhba *.*test*
```

The first wildcard represents an entire name, and the second and third represent individual characters. The result of this command is a list of all vHBAs on all Server Profiles that contains the string “test” in their name.

If you enter:

```
show qos network policer */100m*
```

The first wildcard represents a name string for a Network QoS policer, and the second wildcard represents and characters in the policer rate. The result of this command is a list of all Network QoS policers in any set that limit the CIR to 100 Mbps.

Pipes

You can use pipes to control the display of output in the CLI. Pipes in the XgOS CLI are like standard UNIX pipes, and they use the same syntax. For example, if you enter:

```
show vnic * | grep down
```

The resulting output displays all vNICs in the `down` state. XgOS pipes work with any command, but is used with most effectiveness when coupled with the `grep` command. XgOS pipes are not limited to only one set of pipes; many stages in the pipeline are supported.

Filters

The CLI supports command filters, which are boolean expressions that operate on columns of object output. You can use filters to specify objects that will be displayed in the output of the following `show` commands:

- **`show vnic`**
- **`show vhba`**
- **`show server-profile`**
- **`show physical-server`**

To specify a filter for these commands, append a "where" clause containing operands and operators. Some examples are provided later in this section.

Filters determine specific output (the table columns) that will be displayed when you issue one of the listed commands. The value of a table column in a `show` command can be compared to a constant using one of the operators in the following table.

Operator	Means
=	equal to
<>	not equal to
<	less than
<=	less than or equal to
>	greater than
>=	greater than or equal to
like	regular expression match

Expressions can be combined using “and”, “or”, and “xor”. Expressions can also be enclosed in parentheses.

For example, if you enter:

```
show vnic * where if = 1/1
```

This command shows all vNICs terminated on interface 1/1.

If you enter:

```
show vhba priv*.prod where if-state <> up
```

This command shows vHBAs with a name that starts with “priv” and are on the “prod” server profile, filtering those with an if-state column (interface state) that is not “up”

If you enter:

```
show server-profile * where connection like "extsw" and state = up
```

This command shows all server-profiles that are connected to an external switch and are “up”

If you enter:

```
show server-profile * where vnics > 0 or vhbas > 0
```

This command shows all server profiles that have a vNIC or vHBA on them.

Naming Conventions

Names for objects in the OVN information model should follow these naming guidelines. Here is a partial list of characters that should be avoided when naming server profiles, vNICs, and vHBAs:

- $ which is used by the CLI for textual replacement of expressions.
- / (slash) and ^ (caret) and % (percent sign) cause errors and prevent the named item from being displayed.
- : (colon) causes a permissions error.

Internal blank spaces are accepted when they are enclosed in quotation marks. For example, a server profile named “web apps” is valid, but web apps is not.

While the XgOS CLI and Oracle Fabric Manager do not enforce rules about naming objects, we recommend the following guidelines:

- Characters accepted in the names of vNICs and vHBAs include alphanumerics and underscore (_). Avoid using other characters.
- Characters accepted in the other objects (for example, server profiles, LUN Masks, QoS Profiles, ACLs, and so on) include alphanumerics, dash (-), and underscore (_). Avoid using other characters.

Logging in to the Oracle Fabric Interconnect

You can use the command-line interface through the console or by using a secure shell (SSH). For details about different login methods, see "Login Methods" on page 322.

Generally, you will log in using a secure shell and your own account or the default account. To use the default account, enter the user name admin and the password admin.

Virtual Resources Quick Start

This section provides a brief introduction to the commands used to configure and monitor virtual resources on the system.

Basic Commands

There are several fundamental commands that influence the configuration database and perform basic system functions:

`add`	Create and delete virtual resources
`remove`	Delete virtual resources
`set`	Modify properties of virtual resources
`show`	Display properties of virtual resources
`system`	Perform chassis-related functions:

Server Profile Commands

Server profiles are containers that hold vNICs/vHBAs and are assigned to physical servers. Profiles provide the flexibility to move an I/O personality from one physical server to another.

Server Profile Examples

- Create a server profile for `xserver1` and assign it to the physical server

```
add server-profile xserver1 xserver1@iowa:ServerPort7
```

- Display the properties of all server profiles:

```
show server-profile
```

- Delete the server profile:

```
remove server-profile xserver1
```

- Disconnect a server profile from a physical server:

```
set server-profile xserver1 disconnect
```

Note – This command will cause a service disruption, as a result, a confirmation prompt is displayed to verify the disconnect.

Assign an existing server profile to a server:

```
set server-profile xserver1 connect xserver1@iowa:ServerPort7
```

See "Server Profiles and Gateways" on page 69 for more information.

vNIC Commands

vNICs are given a name and assigned to a server profile and an Ethernet module port.

vNIC Command Examples

- Create a new vNIC for xserver1 and assign it to port 2 on the Ethernet module in slot 8:

```
add vnic vnic0.xserver1 8/2
```

- Give `vnic0` on `xserver1` the IP address of 11.0.0.1 with netmask 255.255.255.0:

```
set vnic vnic0.xserver1 -addr-type=static -ip-addr=11.0.0.1/24
```

- Display the properties of all vNICs:

```
show vnic
```

- Change the netmask on vnic0.xserver1 to 255.0.0.0:

```
set vnic vnic0.xserver1 -netmask=255.0.0.0
```

- Set `vnic0.xserver1` to DHCP:

```
set vnic vnic0.xserver1 -addr-type=dhcp
```

- Change the termination port of a vNIC:

```
set vnic vnic0.xserver1 -if=8/4
```

- Create an HA vNIC with primary port 8/1 and secondary port 8/2:

```
add vnic vnic0.xserver1 8/1 ha 8/2
```

- Delete a vNIC:

```
remove vnic vnic0.xserver1
```

See "Virtual Network Interface Cards (vNICs)" on page 77 for more information.

vHBA Commands

vHBAs are given a name and assigned to a server profile and a Fibre Channel (FC) module port.

vHBA Command Examples

- Create a new vHBA for xserver1 and assign it to port 1 on the FC module in slot 15:

```
add vhba vhba0.xserver1 15/1
```

- Display the targets and LUN IDs the vHBA can detect:

```
show vhba vhba0.xserver1 targets
```

- Display the properties of all vHBAs (WWNN/WWPN):

```
show vhba
```

- Request a vHBA to rescan the SAN fabric:

```
set vhba vhba0.xserver1 rescan
```

Note – You would do this if you changed LUN masking on an array, for example.

---

vHBA prescan commands allow an "unbound" vHBA to perform an NPIV login and "see" the available targets and LUNs. You can only perform these commands on a vHBA and server-profile that is not assigned to a physical server. You can check this by typing `show server-profile` and make sure the state is "up/unassigned".

vHBA Prescan Examples

- Create a server profile and vHBA to scan the fabric:

```
add server-profile testserver
add vhba vhba0.testserver 15/1
show vhba vhba0.testserver (view WWPN to provision LUNs)
```

- Request an unbound vHBA to perform an NPIV login:

```
set vhba vhba0.testserver prescan
```

- If you change LUN masking or if the fabric changes without an RSCN, you must logout/login to "rescan":

```
set vhba vhba0.testserver remove-prescan
set vhba vhba0.testserver prescan
```

- Request an unbound vHBA to logout of the SAN fabric:

```
set vhba vhba0.testserver remove-prescan
```

- Display vHBA targets:

```
show vhba vhba2.testserver targets
```

See "Virtual Host Bus Adapters (vHBAs)" on page 133 for more information.

I/O Card Commands

The I/O modules and ports are the termination points of vNICs and enable vNICs to access network resources.

I/O Card Examples

- Display all I/O cards in the chassis and their status:

```
show iocard
```

- Display the port status of all I/O ports in the chassis:

```
show ioport
```

- Change the MTU of an I/O port to support jumbo frames:

```
set ethernet-port 8/4 -mtu=9194
```

Note – You can only change the MTU of a port when no vNICs are assigned

---

- Display the properties of a specific I/O port:

```
show ioport 8/4
```

- The `show` command shows all parameters for the specified I/O port.

Miscellaneous `Show` Commands

- Display the XgOS version:

```
show system version
```

- Display the current system configuration:

```
show system info
```

- Display management Ethernet info:

```
show system interfaces
```

- Display all logged in users:

```
show login
```

- Display environmental information:

```
show hardware
```

- Display information for supporting an issue:

```
get log-files -all
```

- Display discovered physical servers:

```
show physical-server
```

Virtual Resource Naming Restrictions

As with all computer systems, the names you can set on virtual I/O resources can contain a restricted character set. Names of vNICs and vHBAs can contain:

- the letters A-Z and a-z
- the numerals 0-9
- the underscore character (_)

All other virtual I/O resources, such as server profiles and LUN masks, can contain:

- the letters A-Z and a-z
- the numerals 0-9
- the underscore character (_)

- dash (-)

The names of virtual resources are restricted to the following lengths:

- vNICs: between 2 and 10 characters
- vHBAs: between 2 and 15 characters
- server profiles: between 1 and 31 characters

CHAPTER 2

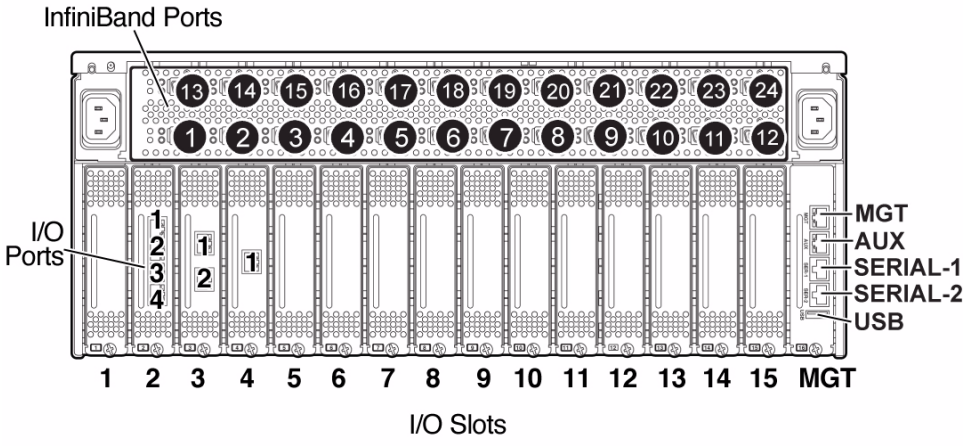
Configuring Hardware Elements

When configuring virtual I/O, you must refer to the various hardware elements of the Oracle Fabric Interconnect. This chapter presents detailed information about those elements and how to refer to those elements on the command line.

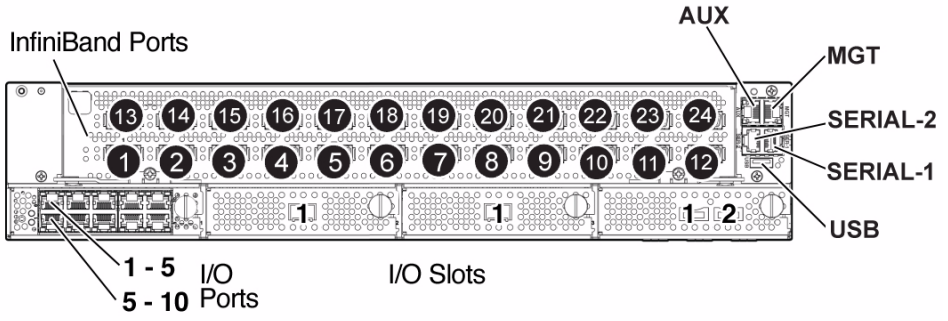
- "Slot/Port Numbering Scheme" on page 17
- "InfiniBand Ports" on page 19
- "I/O Modules" on page 23
- "I/O Ports" on page 29
- "Determining HCA Ports and Checking Firmware Version in Servers" on page 31
- "Hardware Status and Environmentals" on page 32
- "Interfaces and Interface State" on page 44

Slot/Port Numbering Scheme

The following figure illustrates the InfiniBand and I/O ports on the Oracle Fabric Interconnect F1-15.



The following figure illustrates the InfiniBand and I/O ports on an Oracle Fabric Interconnect F1-4.



When referring to an I/O module and port on the command line, you use the form `I/O_Slot/Port_Number`. For example, you must specify a specific slot and port to add a vNIC:

```
add vnic foo.bar ?
```

Possible completions:

```
  14/1   nwEthernet1GbPort in slot 14 port 1 (up) unused
  14/2   nwEthernet1GbPort in slot 14 port 2 (up) unused
  14/3  nwEthernet1GbPort in slot 14 port 3 (up) used by 7 resources
  14/4   nwEthernet1GbPort in slot 14 port 4 (down) unused
  14/5   nwEthernet1GbPort in slot 14 port 5 (down) unused
  14/6   nwEthernet1GbPort in slot 14 port 6 (up) unused
  14/7   nwEthernet1GbPort in slot 14 port 7 (up) unused
```

```
 14/8  nwEthernet1GbPort in slot 14 port 8 (up) used by 8 resources
 14/9   nwEthernet1GbPort in slot 14 port 9 (down) unused
 14/10  nwEthernet1GbPort in slot 14 port 10 (down) unused
```

```
add vnic foo.bar 14/1
```

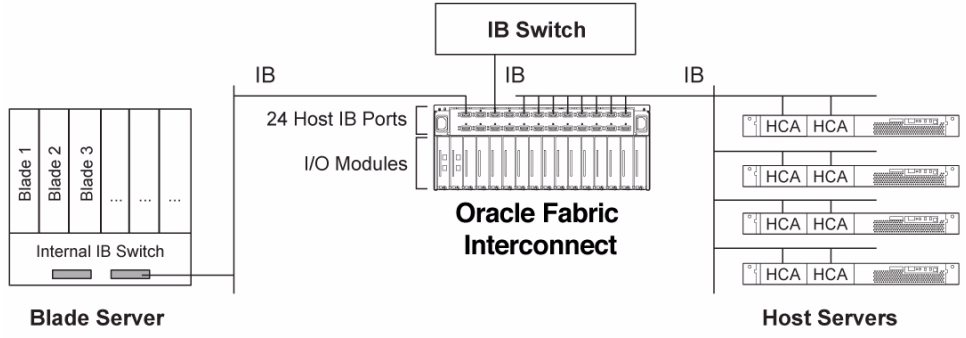
In command output, the module and slot consists of the following information elements:

- connection type, for example either network (nwEthernet) or fibre channel SAN (sanFC)
- port type, for example either Ethernet or Fibre Channel.
- rate, for example 1 gigabit per second (1Gb), 10 Gigabits per second (10Gb)
- slot or port, for example port or module.

InfiniBand Ports

InfiniBand (IB) is a channel based, switched-fabric interconnect for servers. IB interconnects processor nodes and I/O nodes to a system area network. The architecture is independent of the host operating system and processor platform.

The Oracle Fabric Interconnect contains several internal 24-port IB switches (Mellanox). One switch attaches to an internal HCA (IOCPort16). Each external IB port connects to a external *HCA* installed on a remote host server. You can connect an external InfiniBand switch to the Oracle Fabric Interconnect to extend the number of IB ports.



The Oracle Fabric Interconnect contains an embedded Subnet Manager (SM) that manages the switching and pathing tables within the IB fabric. When there are multiple SMs on a subnet, one SM will be the master SM through an election algorithm. The remaining SMs become standby SMs. There is only one master SM per subnet.

The master SM is a key element in initializing and configuring an IB subnet. The master SM is elected as part of the initialization process for the subnet and is responsible for the following:

- Discovering the physical topology of the subnet
- Assigning Local Identifiers (LIDs) to the end nodes, switches, and routers
- Establishing possible paths among the end nodes
- Sweeping the subnet, discovering topology changes and managing changes as nodes are added and deleted.

The communication between the master SM and the SM agents, and among the SMs, is performed with subnet management packets.

Note – If you prefer to use a 3rd-party SM (not the Oracle Fabric Interconnect), see "OpenSM Decoupling" on page 244 for information on how to disable the SM.

Note – The IB specification is posted at http://www.infinibandta.org/specs/register/publicspec/.

Syntax

Use the following CLI commands to display and manage InfiniBand port information:

```
show fabric-port
show physical-server [<name>][*]
```

Example: Display the Fabric Ports

```
show fabric-port
------------------------------------------------------------------
name          chocolate
type          hcaPort
descr
```

```
chassis-port  ServerPort19
id            2c90200204929
state         N/A/up
m-key         0
lid           4
sm-lid        61
link-width    4x
link-speed    2_5_Gbps
----------------------------------------------------------------
 ...
----------------------------------------------------------------
name          south-dakota
type          hcaPort
descr
chassis-port  IOCPort16
id            1397020100013d
state         N/A/up
m-key         0
lid           61
sm-lid        61
link-width    4x
link-speed    2_5_Gbps
----------------------------------------------------------------
36 records displayed
```

Field	Description
`name`	Displayed host name of the server.
`type`	Type of port.
`name`	Port GUID name.
`descr`	User defined port description.
`chassis-port`	Local IB chassis port used for the connection. The Oracle Fabric Interconnect itself has an internal HCA on the SCP used to communicate with the IB fabric. This internal HCA switch port is IOCPort16. This port is the Oracle Fabric Interconnect's representation in the IB framework.
`id`	Globally Unique Identifier (GUID). A persistent number that uniquely identifies a device or component. An HCA is assigned a node GUID that is stored in flash memory. Each port on an HCA is assigned a port GUID. Xsigo's IB vendor ID is 1397.
`state`	The administrative state of the local IB port on the chassis and the operational state of that port, in the form `admin_state/operational_state`.

Field	Description
m-key	Management key. A construct that is contained in InfiniBand Architecture (IBA) management datagrams to authenticate the sender to the receiver.
lid	Local Identifier. An address assigned to a port by the IB Subnet Manager (SM), unique within the subnet, used for forwarding packets within the subnet. The SM manages the switching and routing tables with the IB fabric. The Source and Destination LIDs are present in the Local Route Header. A Local Identifier is formed by the sum of the Base LID and the value of the Path Bits. Unlike a fixed GUID, a LID can change from time-to-time.
sm-lid	The LID where the master SM is located. It is not the SM priority value.
link-width link-speed	Link-width is the number of physical lanes (1, 4, 8, or 12) whereas link speed is the speed of the physical lanes, such as 2.5 Gbps (SDR), 5 Gbps (DDR), or 10 Gbps (QDR). If the link-width field is not 4x, there is something wrong. The InfiniBand Architecture (IBA) defines a number of different link bit rates. The lowest bit rate of 2.5 Gbps is referred to as a 1x (times one) link. Other link rates are 10 Gbps (4x) and 30 Gbps (1x2).

Example: Display the Physical Servers Connected to the Chassis

The OVN host drivers communicate with Xsigo's OpenSM by default. When an IB connected host server boots up, the installed OVN host driver advertises the server's host name to the Oracle Fabric Interconnect.

Issue `show physical-server` command to display the list of InfiniBand-connected servers:

```
show physical-server
name     guid         descr  port              cap   server-profile
-------------------------------------------------------------------
alexander 2c90200204935       iowa:ServerPort8      ef-x  spLinux
```

The alexander server is connected to the Oracle Fabric Interconnect named "iowa" on IB port 8 (iowa:ServerPort8).

When you issue `add server-profile` <*name*>, you will see the reported host server names for which command completion can configure:

```
add server-profile myprofile ?
Possible completions:
alexander@iowa:ServerPort19  Connection to host alexander (up)
```

I/O Modules

Use `show iocard` command to display available I/O line card information in the system.

There are feature differences and capability nuances between the 10-port Gigabit Ethernet and 10 GE Gigabit Ethernet I/O hardware modules. For more details, see "QoS Feature Matrix" on page 195, Chapter 12, and Chapter 7.

Syntax

```
show iocard
show iocard *
show iocard {<slot>|<wildcard>}
show iocard {<slot>|<wildcard>} acl-stats <rule-id>
show iocard {<slot>|<wildcard>} alarms
show iocard {<slot>|<wildcard>} dmesg
show iocard {<slot>|<wildcard>} errors
show iocard {<slot>|<wildcard>} ioport [*|<port>]
show iocard {<slot>|<wildcard>} ioports
show iocard {<slot>|<wildcard>} mac-table
show iocard {<slot>|<wildcard>} qos
show iocard {<slot>|<wildcard>} stats
show iocard {<slot>|<wildcard>} vhbas
show iocard {<slot>|<wildcard>} vnics
show iocard {<slot>|<wildcard>} warnings
```

Example: Display I/O Modules in a F1-15

```
show iocard
slot     state     descr     type                        v-resources
-------------------------------------------------------------------
3          up/up                  sanFc2Port4GbLrCard             6
4          up/up                  sanFc2Port4GbLrCard             0
5          up/up                  nwEthernet4Port10GbCard         6
10         up/up                  nwEthernet1Port10GbCard         0
4 records displayed
```

The field “v-resources” indicates the number of Xsigo virtual resources (vNICs and vHBAs,) that are associated with this card. vNICs can be bound only to network Ethernet cards. vHBAs can be bound only to SAN FC cards. Because slot numbers exceed 4 (for example, slot 10), the output displayed is for a F1-15.

Example: Display I/O Modules in a F1-4

```
show iocard
slot      state       descr          type              v-resources
-------------------------------------------------------------------
1         up/up                    nwEthernet10Port1GbCard       9
2         up/up                    nwEthernet10Port1GbCard       0
3         up/up                    sanFc2Port4GbLrCard           9
4         up/up                    sanFc2Port4GbLrCard           0
4 records displayed
```

The field “v-resources” indicates the number of Xsigo virtual resources (vNICs and vHBAs,) that are associated with this card. vNICs can be bound only to network Ethernet cards. vHBAs can be bound only to SAN FC cards.

Example: Display the MAC Table

```
show ethernet-card 2 mac-table
port            vlan            type               mac-address
-------------------------------------------------------------------
2/2             1               dynamic          00:0e:0c:4a:b8:f2
2/2             40              static           00:13:97:09:85:64
2/2             50              static           00:13:97:09:85:65
2/2             60              static           00:13:97:09:85:66
2/6             10              dynamic          00:0e:0c:4a:b8:f2
2/10            1               dynamic          00:0e:0c:4a:68:d5
2/10            1               dynamic          00:30:48:88:43:7c
2/10            1               dynamic          00:0d:bd:86:96:50
2/10            1               dynamic          00:11:85:a5:21:80
2/10            1               dynamic          00:11:85:a5:2a:7f
2/10            1               dynamic          00:11:85:a5:2a:40
2/10            1               dynamic          00:1d:a2:65:ff:01
2/10            1               dynamic          00:0f:20:e7:e3:01
2/10            1               dynamic          00:14:6c:c5:e2:c2
2/10            1               dynamic          00:13:97:03:50:79
2/10            1               dynamic          00:13:97:00:0f:28
2/10            1               dynamic          00:13:97:00:0f:2e
2/10            1               dynamic          00:13:97:00:00:25
```

```
2/10            1               dynamic             00:13:97:01:a1:13
2/10            1               dynamic             00:13:97:00:02:4f
2/10            1               dynamic             00:13:97:00:00:13
2/10            1               dynamic             00:13:97:80:00:03
2/10            1               dynamic             00:13:97:00:00:16
2/10            1               dynamic             00:13:97:80:00:0f
2/10            1               dynamic             00:13:97:01:a0:c9
2/10            1               dynamic             00:13:97:01:a0:ce
2/10            1               dynamic             00:13:97:00:00:81
2/10            1               dynamic             00:13:97:00:00:86
2/10            1               dynamic             00:14:6c:81:41:36
2/10            1               dynamic             00:03:f4:02:45:d4
30 records displayed
```

The command shows information about a 10-Port GE module in slot 2 including the VLAN number on the port, the type of MAC address and the MAC address(es) associated with the port.

Controlling I/O Modules

The `set iocard` command can shut down, turn up, or reset I/O modules.

Syntax

```
set iocard {*|<slot#>} clear-stats
set iocard {*|<slot#>} down
set iocard {*|<slot#>} reset
set iocard {*|<slot#>} up
set iocard {*|<slot#>} -descr="<text>"
set iocard {*|<slot#>} -type=<value>
```

These commands are supported on I/O modules only. The front panel, SCP, and InfiniBand fabric board are not affected.

Parameter Description

Parameter	Description
`<slot#>|* down`	Causes one or all I/O modules to be deactivated. When the shutdown occurs, all power to the affected I/O module is turned off. When you issue this command, a warning message is displayed, and you are prompted for confirmation before the module is shutdown. By default, the module is not shut down. If you want the module shutdown, you must explicitly answer yes (y) to the prompt.
`<slot#>|* up`	Reactivates one, or all, of the I/O modules that are inactive. Bringing a module up is the opposite of shutting down a module. When the modules are started, all power is turned on to the affected modules. By default, the module is brought up without confirmation.
`"<text>"`	Specifies an optional description string. If the string will contain multiple words that are separated by blank spaces (for example, the Oracle Fabric Interconnect), you must enclose the description string in double quotation marks—for example, "Oracle Fabric Interconnect"
`<value>`	Sets the kind of I/O module that is in the slot. This option is useful in cases where slots are pre-provisioned for an I/O module before the I/O module is installed. The following options are supported: • `nwEthernet10Port1GbCard` for a 10-port 1 Gbps Ethernet card • `nwEthernet1Port10GbCard` for a 1-port 10 Gbps Ethernet card • `nwEthernet4Port10GbCard` for a 4-port 10 Gbps Ethernet card • `sanFc2Port4GbLrCard` for a Line Rate Fibre Channel card

Caution – If you are pre-provisioning, when you actually install hardware modules, make sure you get the right module type in the right slot. For example, if slot 13 is pre-provisioned for a 10 GE module, make sure that a 10 GE module is installed in slot 13. As an alternative, you can issue the `set iocard <slot> -type` command to set change a module type for a slot before the module is inserted.

Example: Shut Down a Single I/O Module

To shut down a single I/O module:

```
set iocard 8 down
Shutting down IO cards will adversely affect any virtual IO
resource connected
to them and thus cut IO to the physical servers.
Are you sure you want to shutdown the IO card in slot 13 (y/n)?
```

Example: Bring Up an I/O Module

To bring up a single I/O module:

```
set iocard 8 up
```

Resetting I/O Modules

A module reset powers down one or all modules in the chassis, then powers them back up.

Note – This command is supported on I/O modules only. The front panel, SCP, and fabric board are not affected.

You can reset an I/O module by issuing the `set iocard reset` command. This command has an option to reset all cards by using the asterisk wildcard character (*), or a single card by specifying the number of the slot where the card is installed.

Here are some examples of resetting an I/O module. The following command resets a single module in slot 8:

```
set iocard 8 reset
```

The following command resets all I/O modules in the chassis:

```
set iocard * reset
```

Installing and Monitoring 1-Port 10GbE I/O Modules

The 1-Port 10GbE I/O module can be installed in any slot on the chassis. It supports the following features:

- 128 vNICs per card
- Card-level High Availability (HA)
- Access Control List (flow) policing
- QoS on the vNICs configured on the card
- MTU sizes from 1500 bytes to 9194 Kbytes
- IPv4 TCP/UDP checksum offload. If you want TCP Offload configured on the vNIC, you must set this value at vNIC creation time. You cannot edit a configured vNIC to add the Offload feature later.
- Untagged VLANs. Each vNIC can be assigned to a single untagged VLAN (between 1 - 4000)
- 8 traffic queues per vNIC
- IGMP snooping. IGMP versions supported: v1, v2, v3 (partially supported)
- Flow learning and statistics
- 512 multicast groups
- 802.1p, TOS, and DSCP mapping

To monitor 1-Port 10GbE I/O modules, use `show ioport` to inspect the state and configuration information on the ports.

The following example displays a port on a card installed in slot 8:

```
show ioport 1/1
--------------------------------------
name            1/1
type            nwEthernet10Port1GbCard
state           up/up
descr
rate            auto/1 Gbps
mtu             1500
avail-in-cir    1 Gbps
avail-out-cir   1 Gbps
mode            access
flags           -s
vnics           2
vlans           none
--------------------------------------
1 record displayed
```

The following example displays the card installed in slot 8:

```
show iocard 1
--------------------------------------
slot     1
state    up/up
```

```
descr
type     nwEthernet10Port1GbCard
vnics    2
qos      default
acl      acl1
enables  qas
-------------------------------------------------------------------
1 record displayed
```

I/O Ports

Use `show ioport` to display I/O port information on an I/O port.

Syntax

```
show ioport
show ioport *
show ioport <slot/port> [-detail]
show ioport <slot/port> alarms [-detail]
show ioport <slot/port> qos [-detail]
show ioport <slot/port> stats [-detail]
show ioport <slot/port> vhbas [-detail]
show ioport <slot/port> vnics [-detail]
```

Examples

```
show ioport
name            type                    state         descr         v-resources
-------------------------------------------------------------------------------
1/1           nwEthernet1GbPort       up/up                              2
1/2           nwEthernet1GbPort       up/up                              0
1/3           nwEthernet1GbPort       up/down                            0
1/4           nwEthernet1GbPort       up/down                            0
1/5           nwEthernet1GbPort       up/up                              0
1/6           nwEthernet1GbPort       up/up                              0
1/7           nwEthernet1GbPort       up/up                              0
1/8           nwEthernet1GbPort       up/down                            0
1/9           nwEthernet1GbPort       up/down                            0
1/10          nwEthernet1GbPort       up/up                              0
2/1           nwEthernet1GbPort       up/up                              6
```

```
2/2             nwEthernet1GbPort       up/up                   0
2/3             nwEthernet1GbPort       up/up                   0
2/4             nwEthernet1GbPort       up/up                   0
2/5             nwEthernet1GbPort       up/up                   0
2/6             nwEthernet1GbPort       up/down                 0
2/7             nwEthernet1GbPort       up/up                   0
2/8             nwEthernet1GbPort       up/up                   0
2/9             nwEthernet1GbPort       up/down                 0
2/10            nwEthernet1GbPort       up/up                   0
3/1             sanFcPort               up/up                   4
3/2             sanFcPort               up/down                 0
4/1             sanFcPort               up/up                   0
4/2             sanFcPort               up/up                   0
5/1             nwEthernet10GbPort      up/up                   4
5/2             nwEthernet10GbPort      up/up                   0
5/3             nwEthernet10GbPort      up/up                   0
5/4             nwEthernet10GbPort      up/up                   0
```

```
show ioport 3/1
-------------------------------------------------------------------
name   3/1
type   sanFcPort
state  up/up
descr
wwnn   50:01:39:71:00:00:B0:1F
wwpn   50:01:39:70:00:00:B0:1F
vhbas  4
-------------------------------------------------------------------
1 record displayed

show ioport 3/1 -detail
-------------------------------------------------------------------
name                          3/1
type                          sanFcPort
state                         up/up
descr
wwnn                          50:01:39:71:00:00:B0:1F
wwpn                          50:01:39:70:00:00:B0:1F
rate                          auto/4Gbps
frame-size                    2048/2048
exec-throttle                 65535
int-delay                     1000
fc-link-down-timeout          60
login-retry                   8
login-timeout                 4
fc-target-port-down-timeout   60
```

```
topo                          F
loop-delay                    5
tape-support                  true
vhbas                         4
-------------------------------------------------------------------
1 record displayed
```

Determining HCA Ports and Checking Firmware Version in Servers

Servers can contain single- or dual-port HCA cards. You can determine whether a single-port or dual-port HCA is installed in a server, as well as determining what firmware version is loaded on the HCAs by searching for relevant strings. The value returned from the search indicates the HCA type or the HCA firmware version.

For HCA cards, the value is a model number. The following table shows the model number returned and the type of HCA card.

Card Type	Minimum Firmware Revision	Description
MT25204	1.2.0	Single port PCIe card
MT25208 (Linux) / MT25218 (Windows)	5.1.4	Dual port PCIe card

For the card type, the model number indicates what type of HCA is installed. Each dual-port card HCA has its own model number.

- On a Linux server, to check the HCA card type, use the `cat` command as shown:

```
# cat /sys/class/infiniband/mthca0/hca_type
MT25204
```

- In this example, the HCA type is an MT25204, which is a single port PCIe card.
- The Oracle Fabric Interconnect uses only memory-free HCAs. Because of the way Linux queries the HCA, the dual port HCA is displayed as MT25208 (mem-based) whenever the `cat` command is used to query the HCA even though the HCA is actually a mem-free card. On a Windows server, to check the HCA card type, use the Device Manager by following the menu path System Properties -> Device Manager, then locating the InfiniBand Host Channel Adapter.

The Oracle Fabric Interconnect uses only memory-free HCAs. Because of the way Windows queries the HCA for firmware information, Windows can determine whether the HCA card is mem-based or mem-free. As a result, the dual port HCA is correctly displayed as MT25218 whenever the Device Manager is used to query the HCA. For the firmware version, the value is the current revision level.

- To check the firmware version, use the `cat` command as shown:

```
# cat /sys/class/infiniband/mthca0/fw_ver
1.2.0
```

In this example, the MT25204 has firmware version 1.2.0 installed.

Hardware Status and Environmentals

Issue the `show hardware` command to display hardware information and environmental statistics for the Oracle Fabric Interconnect. Various models of Oracle Fabric Interconnect are supported for the Oracle Fabric Interconnect F1-4 and Oracle Fabric Interconnect F1- 15, and there are some differences in the hardware configuration of each. The main differences are:

- The Oracle Fabric Interconnect F1-15 is a 4 rack-unit system with a maximum of 15 slots for I/O modules. The Oracle Fabric Interconnect F1-15 has an InfiniBand fabric supporting SDR (10 Gbps), DDR (20 Gbps), or QDR (40 Gbps) connections to host servers with InfiniBand HCAs.
- The Oracle Fabric Interconnect F1-4 is a 2 rack-unit system which supports a maximum of 4 I/O modules. The Oracle Fabric Interconnect F1-4 has an InfiniBand fabric supporting SDR (10 Gbps), DDR (20 Gbps), or QDR (40 Gbps) connections to host servers
- The Oracle Fabric Interconnect Oracle Fabric Interconnect F1-15 power supplies (PSUs) are on the rear of the chassis, and the Oracle Fabric Interconnect F1-4 PSUs are on the front.

Additional commands are available to show the hardware status of the Oracle Fabric Interconnects, such as `show fabric-port`, `show config`, and `show system info`.

Syntax

```
show hardware
```

Example: Display Hardware Status for an Oracle Fabric Interconnect F1-15

The `show hardware` command displays comprehensive output of all the important hardware information for a Oracle Fabric Interconnect. This example is for a F1-15 with an SDR fabric.

```
show hardware
# Model: F1-15-CH-DDR
# Serial: 410510043
# Base MAC: 00:13:97:01:20:00
# Base WWN: 50:01:39:70:00:00:20:00
# Locator LED: off
#
# Date: Wed Jan 25 16:13:38 PST 2012
# User: admin
#
#
## IO Card Version status ########################################

slot type                          model           part-num           serial
  vchip-ver  xt-ver       primary-boot-ver secondary-boot-ver diag-ver
-------------------------------------------------------------------------------
4    nwEthernet4Port10GbCardEthIb VPE-MOD-10GE-4P 705-00094-01.01.09 321111829
  N/A       1.0.36843[IB] 4.00.19          4.00.17            4.19
5    nwEthernet1Port10GbCard      VP-MOD-10GE-1P  705-00018-03.02.06 500812687
  N/A       1.0.35348     4.00.19          4.00.07            4.19
6    sanFc2Port4GbCard            VP-MOD-FC-2P    705-00015-02.02.05 500812736
  1.0.29167 1.0.34543     4.00.19          4.00.07            4.19
8    nwEthernet10Port1GbCardEthIb VPE-MOD-1GE-10P 705-00070-03.01.02 521019122
  N/A       1.0.35787[IB] 4.00.19          4.00.16            4.19
9    sanFc2Port8GbLrCardEthIb     VP-MOD-8FC-2P   705-00074-01.01.03 031119288
  4.0.35913 1.0.35787     4.00.19          4.00.07            4.19
10   sanFc2Port4GbCard            VP-MOD-FC-2P    705-00015-01.01.07 080610376
  1.0.29167 1.0.34543     4.00.19          4.00.07            4.19
12   sanFc2Port4GbLrCardEthIb     VPE-MOD-4FC-2P  705-00072-02.01.03 061119840
  3.0.34198 1.0.35787     4.00.19          4.00.07            4.19
14   nwEthernet10Port1GbCard      VP-MOD-1GE-10P  705-00025-03.02.06 400812310
  N/A       1.0.35348     4.00.19          4.00.07            4.19
15   nwEthernet1Port10GbCard      VP-MOD-10GE-1P  705-00018-01.01.00 490610749
  N/A       1.0.35348     4.00.19          4.00.07            4.19
9 records displayed

## IO Card Environment status ###################################

slot type                          state temperatures voltages
```

```
-------------------------------------------------------------
4    nwEthernet4Port10GbCardEthIb up    in=34 out=48 0v9=0.89 1v2=1.20
                                                    1v8=1.82 1v8ldo=1.80
                                                    2v57=2.57 2v5=2.51
                                                    3v3=3.29 3v3sb=3.29
                                                    current=4.37 power=52.89
                                                    vps_12v0=12.09
5    nwEthernet1Port10GbCard      up    in=35 out=46 1v2=1.20 1v5=1.51
                                                    1v8=1.80 2v5=2.50
                                                    2v6=2.59 3v3=3.29
                                                    3v3sb=3.29 5v0=5.03
6    sanFc2Port4GbCard            up    in=36 out=41 1v2=1.20 1v5=1.50
                                                    1v8=1.80 2v5=2.51
                                                    2v6=2.60 3v3=3.29
                                                    3v3sb=3.29
8    nwEthernet10Port1GbCardEthIb up    in=33 out=56 0v9=0.89 1=0.99 1v2=1.19
                                                    1v8=1.79 2v5=2.50
                                                    3v3=3.29 3v3sb=3.29
                                                    3v5=3.45
9    sanFc2Port8GbLrCardEthIb     up    in=33 out=45 0v9=0.89 1v0=0.99
                                                    1v2=1.19 1v8=1.80
                                                    2v5=2.50 3v3=3.29
                                                    3v3sb=3.29 3v5=3.48
10   sanFc2Port4GbCard            up    in=34 out=42 1v2=1.19 1v5=1.48
                                                    1v8=1.79 2v5=2.51
                                                    2v6=2.58 3v3=3.29
                                                    3v3sb=3.29
12   sanFc2Port4GbLrCardEthIb     up    in=33 out=40 0v9=0.89 1v0=1.02
                                                    1v2=1.19 1v8=1.80
                                                    2v5=2.50 3v3=3.29
                                                    3v3sb=3.29 3v5=3.48
14   nwEthernet10Port1GbCard      up    in=38 out=65 1=0.99 1v2=1.20 1v5=1.48
                                                    1v8=1.83 2v5=2.51
                                                    2v6=2.58 3v3=3.29
                                                    3v3sb=3.29
15   nwEthernet1Port10GbCard      up    in=33 out=48 1v2=1.19 1v5=1.51
                                                    1v8=1.80 2v5=2.49
                                                    2v6=2.57 3v3=3.27
                                                    3v3sb=3.29 5v0=5.03
9 records displayed


## Front Panel Version status ################################################

model      serial     xt-ver  primary-boot-ver  secondary-boot-ver  diag-ver
-------------------------------------------------------------------------------
VP-FRU-FP  XG1AA0032          4.00.19           4.00.07             4.19
1 record displayed
```

```
## Front Panel Environment status ##############################################

state temperatures voltages
------------------------------------------------------------------------------
up    in=29 out=30 1v2=1.20 1v5=1.50 1v8=1.79 2v5=2.48 2v6=2.60 3v3=3.26
                   3v3sb=3.29 5v0=5.00
1 record displayed


## Fabric Card status ##########################################################

name model          serial    state speed temperatures        voltages
------------------------------------------------------------------------------
1    VP-FRU-FB-DDR 070913118 up    DDR   in=36 mid=39 out=39 1v2_1=1.19
                                                           1v2_2=1.19
                                                           1v2_3=1.19
                                                           1v6_1=1.59
                                                           1v6_2=1.57
                                                           1v8=1.77 3v3=3.29
                                                           3v3sb=3.29
1 record displayed

## System Control Processor status #############################################

serial    cpu-usage mem-usage temperatures                              voltages
------------------------------------------------------------------------------
133100015 3.02046   38.8648   hd_temp_current=33 hd_temp_maximum=40
                              hd_temp_minimum=19
1 record displayed

### Power supply status ######################################################

model         id  descr  state               serial     vendor-model
------------------------------------------------------------------------------
F1-15-FRU-PS  1          up/down(unplugged)  TE2684200  CAR1212FPBCX-Y04A
F1-15-FRU-PS  2          up/up               SB2540800  CAR1212FPCXXXX-4A
2 records displayed

## Fan controller status ######################################################

model             state      serial-num      actual-temp      max-temp
------------------------------------------------------------------------------
F1-15-FRU-FC      up         XG1AA0042       34               65
1 record displayed


## Fan status #################################################################
```

```
name          descr      state      actual      expected      deviation
-------------------------------------------------------------------------------
Fan-1/1                  up         4800        4800          0
Fan-1/2                  up         5160        4800          360
Fan-2/1                  up         4800        4800          0
Fan-2/2                  up         4560        4800          -240
Fan-3/1                  up         4800        4800          0
Fan-3/2                  up         4440        4800          -360
Fan-4/1                  up         4800        4800          0
Fan-4/2                  up         4440        4800          -360
8 records displayed
```

Example: Show Fabric Board Information for an Oracle Fabric Interconnect F1-15 (QDR Fabric)

The `show hardware` command display information about the type and speed of Fabric Board in the Oracle Fabric Interconnect. Scrolling through the `show hardware` output displays the Fabric Card Status section, where additional information is displayed.

```
show hardware
#
# Xsigo System Hardware Status
# Model: F1-15-CH-QDR
# Serial: 4d05a0792
# Base MAC: 00:11:22:33:44:55
# Base WWN: 00:21:22:23:24:25:26:27
# Locator LED: off
#
# Date: Wed Jan 18 16:14:36 PST 2012
# User: me
#

...
## Fabric Card status ############################################################

name model         serial    state speed temperatures        voltages
-------------------------------------------------------------------------------
1    VP-FRU-FB-QDR 331019032 up    QDR   in=25 mid=27 out=26 1v2_1=1.20
                                                           1v2_2=1.20
                                                           1v8=1.80 2v5=2.50
                                                           3v3=3.29
                                                           3v3sb=3.29
```

Also, the `show fabric-port` command shows the fabric type and speed for an individual Fabric Board with a connected host. The following example shows a QDR fabric port.

```
show fabric-port zergrush:ServerPort1
-----------------------------------------------------------------
name         zergrush:ServerPort1
type         switchPort
descr
port         N/A
id           1
state        up/up
m-key        0
lid          0
sm-lid       0
link-width   4x
link-speed   10_0_Gbps
-----------------------------------------------------------------
1 record displayed
```

The `show config` command displays a scrolling output that includes fabric type and speed information as well.

```
show config
#
# Xsigo System Configuration
# Model: F1-15-CH-QDR
# Serial: 4d05a0792
#
# Date: Wed Jan 18 16:20:13 PST 2012
# User: me
#
...

## System information
##########################################################

-----------------------------------------------------------------
hostname                peonrush
descr
domain                  xlab.xsigo.com
address                 192.168.1.1
netmask                 255.255.255.0
nameservers             192.168.90.144, 192.168.90.142
model-num               F1-15-CH-QDR
serial-num              4d05a0792
ipconfig                dhcp
default-gateway         192.168.45.117
```

```
timezone                America_Los_Angeles
domain-search
is-sm                   true
console-speed           115200
console-speed-rotation  true
phone-home              false
------------------------------------------------------------------
1 record displayed
...

## Fabric ports
##################################################################

------------------------------------------------------------------
name         zergrush:ServerPort1
type         switchPort
descr
port         N/A
id           1
state        up/up
m-key        0
lid          0
sm-lid       0
link-width   4x
link-speed   10_0_Gbps
(more output is available) [SPACE=page, CR=line, d=dis
```

Finally, you can use the `show system info` command to display a quick summary of the Oracle Fabric Interconnect's essential information

Example: Show Hardware Status for an Oracle Fabric Interconnect F1-4

```
show system info
------------------------------------------------------------
hostname                peonrush
descr
domain                  xlab.xsigo.com
address                 192.168.1.1
netmask                 255.255.255.0
nameservers             192.168.90.144, 192.168.90.142
model-num               F1-15-CH-QDR
serial-num              4d05a0792
ipconfig                dhcp
default-gateway         192.168.45.117
```

```
timezone                America_Los_Angeles
domain-search
is-sm                   true
console-speed           115200
console-speed-rotation  true
phone-home              false
root-ssh-login          enabled
------------------------------------------------------------
1 record displayed
```

The `show hardware` command displays comprehensive output of all the important hardware information for a Oracle Fabric Interconnect. This example is for a F1-4 with a DDR fabric.

```
show hardware
#
# Xsigo System Hardware Status
# Model: F1-4-CH-DDR
# Serial: 06f014b16
# Base MAC: 00:13:97:1C:D0:00
# Base WWN: 50:01:39:70:00:1B:E0:00
# Locator LED: off
#
# Date: Mon Jul 18 11:00:14 PDT 2011
# User: admin
#
## IO Card Version status ##################################################

slot type                   model         part-num          serial    vchip-ver
xt-ver    primary-boot-ver secondary-boot-ver diag-ver
------------------------------------------------------------------------------
1    nwEthernet10Port1GbCard VP-MOD-1GE-10P 705-00025-03.02.06 400812298 N/A
1.0.26696 3.00.26          3.00.22            3.38
2    nwEthernet10Port1GbCard VP-MOD-1GE-10P 705-00025-03.02.06 400812236 N/A

1.0.26696 3.00.26          3.00.22            3.38
3    sanFc2Port4GbLrCard     VP-MOD-2P-4FC  705-00026-01.01.07 150811045
1.0.30590 1.0.23689 3.00.26          3.00.24            3.38
4   sanFc2Port4GbLrCard    VP-MOD-2P-4FC 705-00015-02.02.03 250712813 1.0.29167
1.0.23689 3.00.26          3.00.22            3.38

4 records displayed

## Front Panel Version status ############################################

model      serial     xt-ver  primary-boot-ver  secondary-boot-ver  diag-ver
------------------------------------------------------------------------------
VP-FRU-FP  120810715          3.00.26           3.00.22             3.38
```

```
1 record displayed

## Front Panel Environment status ################################################

state temperatures voltages
------------------------------------------------------------------------------
up    in=25 out=23 1v2=1.20 1v5=1.51 1v8=1.79 2v5=2.50 2v6=2.62 3v3=3.29
                3v3sb=3.29 5_d2=5.00
1 record displayed

## Fabric Card status ############################################################

name model          serial    state speed temperatures        voltages
------------------------------------------------------------------------------
1    VP-FRU-FB-DDR 470914668 up    DDR   in=28 mid=31 out=28 1v2_1=1.20
                                                           1v2_2=1.20
                                                           1v2_3=1.20
                                                           1v6_1=1.60
                                                           1v6_2=1.60
                                                           1v8=1.77 3v3=3.29
                                                           3v3sb=3.29
1 record displayed

## System Control Processor status ##############################################

serial   cpu-usage mem-usage temperatures                              voltages
------------------------------------------------------------------------------
35616006 3.901     42.0983   hd_temp_current=28 hd_temp_maximum=52
                             hd_temp_minimum=15
1 record displayed


## Power supply status ###########################################################

id descr state                                model        serial    vendor-model
------------------------------------------------------------------------------
1        up/up                                 F1-4-FRU-PS 8G0000G0A DS1200-3-004
2        up/failed(acFault,overVoltageFault) F1-4-FRU-PS 8G0000L0A DS1200-3-004
2 records displayed

## Fan status ####################################################################

name          descr      state      actual      expected      deviation
------------------------------------------------------------------------------
Fan-1/1                  up         17760       15000         2760
Fan-1/2                  up         17040       15000         2040
Fan-1/3                  up         17760       15000         2760
Fan-1/4                  up         16680       15000         1680
Fan-2/1                  up         17760       15000         2760
```

```
Fan-2/2                 up          17040       15000          2040
Fan-2/3                 up          17640       15000          2640
Fan-2/4                 up          16680       15000          1680
Fan-3/1                 up          18360       15000          3360
Fan-3/2                 up          16320       15000          1320
Fan-3/3                 up          17760       15000          2760
Fan-3/4                 up          16560       15000          1560
12 records displayed


## Fan controller status ##########################################################

state           serial-num           actual-temp           max-temp
-------------------------------------------------------------------------------
up              071014903            23                    65
1 record displayed
```

Examples: Show Fabric Board Information for an Oracle Fabric Interconnect F1-4 (QDR Fabric)

The `show hardware` command display information about the type and speed of Fabric Board in the Oracle Fabric Interconnect. Scrolling through the `show hardware` output displays the Fabric Card Status section, where additional information is displayed.

```
show hardware
#
# Xsigo System Hardware Status
# Model: F1-4-CH-QDR
# Serial: R2D234092
# Base MAC: 00:10:12:1C:30:4f
# Base WWN: 51:11:51:11:51:11:51:11
# Locator LED: off
#
# Date: Thu Jan 19 14:09:16 PST 2012
# User: me
#

...

## Fabric Card status
##########################################################

name model        serial    state speed temperatures       voltages
-----------------------------------------------------------------
```

```
1    VP-FRU-FB-QDR 331018983 up    QDR   in=25 mid=27 out=26 1v2_1=
1.19
                                                          1v2_2=1.19
                                                    1v8=1.79 2v5=2.50
                                                            3v3=3.27
                                                          3v3sb=3.29
1 record displayed
```

Also, the `show fabric-port` command shows the fabric type and speed for an individual Fabric Board with a connected host. The following example shows a QDR fabric port.

```
show fabric-port hyrdalisk:ServerPort1
-------------------------------------------------------------------
name         hydralisk:ServerPort1
type         switchPort
descr
port         N/A
id           1
state        up/up
m-key        0
lid          0
sm-lid       0
link-width   4x
link-speed   10_0_Gbps
-------------------------------------------------------------------
1 record displayed
```

The `show config` command displays a scrolling output that includes fabric type and speed information as well.

```
show config
#
# Xsigo System Configuration
# Model: F1-4-CH-QDR
# Serial: R2D234092
#
# Date: Wed Jan 18 16:20:13 PST 2012
# User: me
#

...

## System information
############################################################
------------------------------------------------------------------
hostname                hydralisk
descr
```

```
domain                  xlab.xsigo.com
address                 192.168.1.2
netmask                 255.255.255.0
nameservers             192.168.90.144, 192.168.90.142
model-num               F1-4-CH-QDR
serial-num              4R2D234092
ipconfig                dhcp
default-gateway         192.168.45.117
timezone                America_Los_Angeles
domain-search
is-sm                   true
console-speed           115200
console-speed-rotation  true
phone-home              false
------------------------------------------------------------------
1 record displayed

...

## Fabric ports
##################################################################
------------------------------------------------------------------
name        zergrush:ServerPort1
type        switchPort
descr
port        N/A
id          1
state       up/up
m-key       0
lid         0
sm-lid      0
link-width  4x
link-speed  10_0_Gbps
(more output is available) [SPACE=page, CR=line, d=dis]
```

Finally, you can use the `show system info` command to display a quick summary of the Oracle Fabric Interconnect's essential information

```
show system info
------------------------------------------------------------
hostname                hydralisk
descr
domain                  xsigo
address                 192.168.1.2
netmask                 255.255.240.0
nameservers             192.168.119.2, 192.168.119.3
model-num               F1-4-CH-QDR
serial-num              4R2D234092
```

```
ipconfig                dhcp
default-gateway         192.168.48.1
timezone                America_Los_Angeles
domain-search
is-sm                   true
console-speed           115200
console-speed-rotation  true
phone-home              true
root-ssh-login          enabled
-------------------------------------------------------------
1 record displayed
```

Interfaces and Interface State

Each slot/port has its own interface (if) with state information (if-state):

```
show vnic
-------------------------------------------------------------------
name      myvinc.myserver
state     up/up
mac-addr  00:13:97:01:80:0B
ipaddr
if            4/1
if-state      up
ha-state
local-id  0
type
vlans     none
qos       --

show vhba
-------------------------------------------------------------------
name          myvhba.myserver
state         up/up
fabric-state  up
if            4/1
if-state      up
wwnn          50:01:39:71:00:00:B1:25
wwpn          50:01:39:70:00:00:B1:25
map
lun-mask
local-id      0
```

CHAPTER 3

XgOS File System Access and Logging

The XgOS CLI provides a basic, unix-like file system. This chapter present the following topics about using that file system and about the system logs stored there:

- "File System Structure" on page 45
- "Default Login" on page 46
- "All user data is stored in the `User data` partition on the hard drive:" on page 46
- "Logging" on page 51

File System Structure

The XgOS CLI provides the following top-level directories:

`bin`	`/bin` contains binary files.
`sbin`	`/sbin` contains system binaries not available to users.
`etc`	
`skins`	`/skins` contains skin definitions for the CLI commands. The default skin is the "xsigo" skin. For example, see `cat /etc/skin`, `/etc/xsigorc`.
`home`	`/home` contains users' home directories
`log`	
`config`	
`usb`	`/usb` is the USB port on the Management module.

Default Login

The default login home directory is /home/admin:

```
pwd
/home/admin
```

All user data is stored in the `User data` partition on the hard drive:

```
show system
...
DISK STATUS
Partition              Size  Available       Used %used
Base OS           253.967M    77.037M   163.816M  64%  |#############--------|
XgOS                1.192G   486.004M   672.297M  55%  |############----------|
System logs         9.169G     8.545G   161.801M   1%  |----------------------|
Database            8.249G     7.513G   323.953M   3%  |----------------------|
Temporary data      6.040G     4.588G     1.144G  18%  |###-------------------|
User data           2.752G     2.115G   509.047M  18%  |###-------------------|
Volatile data     184.901M   175.341M     0.014M   0%  |----------------------|
Config data        44.292M    41.932M     0.073M   0%  |----------------------|
```

File Operations

The `file` command enables you to perform a variety of file operations.

Syntax

```
file copy <from-url> <to-url> [-force]
file archive [-noconfirm] <dest-file> <src-file1> <src-file2> ...
file unarchive <filename>
file compress [-noconfirm] <filename>
file uncompress <filename>
file upload <filename>
file download <filename>

file diff <file1> <file2>
file edit <filename>
file find <filename> <file-pattern>
```

```
file hash <filename>
file list [-long] [-recursive] [-short]
file move <file1> <file2> [-force][-query]
file remove <filename> [-force] [-query] [-recursive]
file search [<searchpattern>][-except][-ignorecase][-linenumbers][-recursive]
file show <filename> [-archive][-compressed]
```

Parameter Description

Command	Description
`file copy <from-url> <to-url> [-force]`	Copies a file from a source location to a destination. Replace `<from-url>` with a URL containing the source location from which the file will be copied. Replace `<to-url>` with a URL containing the file-path destination. All copy schemes have the following syntax: `scheme://user@host/image-path.xpf` You can omit the `user@` portion if the same user name is available on the server from which you are loading the XPF file. If the scheme is a file:, you can omit the host. • `http://<file-path>`—Copies using HTTP. • `https://<file-path>`—Copies using HTTPS. • `scp://<file-path>`—Copies using SCP. • `file://<file-path>`—Copies from a file stored locally on the Oracle Fabric Interconnect. For example from disk, USB (a mounted /usb device), or a /home directory. • `ftp://<file-path>`—Copies using FTP. Use `-force` to copy a file immediately without prompting for confirmation.
`file archive [-noconfirm] <dest-file> <src-file1> <src-file2>`	Creates a file archive.
`file compress [-noconfirm] <filename>`	Compresses a file archive.
`file unarchive <filename>`	Unpacks a file archive.
`file uncompress <filename>`	Uncompresses a file archive.

Command	Description
`file upload <filename>`	Specifies the file on the Oracle Fabric Interconnect that will be uploaded to `ftp.xsigo.com`. You can view a list of local files by using command completion for file upload. This command assumes "ftpguest" as the username and password for the connection to `ftp.xsigo.com`. Use this command when directed by Customer Support, or contact Customer Support immediately after using this command to notify them of the incoming file.
`file download <filename>`	Specifies the file that will be downloaded from ftp.xsigo.com to the current working directory on the Oracle Fabric Interconnect. This command looks for the file in the `/outgoing` directory of `ftp.xsigo.com`. If you receive the error message "Failed to retrieve file outgoing/<file name>" the file could not be found in the `/outgoing` directory. This command assumes "ftpguest" as the username and password for the connection to `ftp.xsigo.com`. Use this command only when directed by Customer Support. They will indicate the name of the file that you will be downloading.
`file diff <file1> <file2>`	Displays the difference between two files.
`file edit <filename>`	Edits a file.
`file find <filename> <file-pattern>`	Finds a file based on a pattern characters.
`file hash <filename>`	Calculates the MD5 hash of the file contents.
`file list`	Displays the list of files. The following parameters are supported: • `-long`—Lists files with expanded output, such as owner, mode bits, and so on. • `-recursive`—Lists the entire file tree by traversing sub-directories. • `-short`—Lists files with basic output, such as just a list of file names. This option is the default.
`file move <file1> <file2>`	Moves one or more files. The following parameters are supported: • `-force`—Moves the file(s) immediately and without prompting for confirmation. • `-query`—Moves a file(s) but prompts for confirmation before the file is actually moved.

Command	Description
`file remove <filename> [-force] [-query] [-recursive]`	Deletes a file. The following parameters are supported: • `-force`—Removes a file immediately and without prompting for confirmation. • `-query`—Removes a file but prompts for confirmation before the file is actually deleted. • `-recursive`—Removes an entire file tree by descending into directories.
`file search`	Searches files for regular expressions. The following parameters are supported: • `<searchpattern>`—Regular expression to search for. • `-except`—Finds everything except the regular expression. • `-ignorecase`—Ignores case in search. • `-linenumbers`—Shows line numbers for matching lines. • `-recursive`—Searches sub-directories.
`file show <filename>`	Displays the contents of a file. The following parameters are supported: • `-archive`—Displays the contents of an archive (TAR or TGZ) file. • `-compressed`—Displays the contents of a compressed (GZIP) file.

Note – The copy schemes are used by the `system upgrade` command. See "System Image Upgrades" on page 313.

Note – For ease-of-use reasons, the file archive and file compress commands do not use the auto-completion feature of the CLI. This allows you to work easily with files that have similar names.

Example: Collect Debug Information and Use Redirect

To collect debug data for Oracle customer support by using the redirect function (>):

```
show tech-support > mydebug
file copy mydebug
    scp://joeuser@computefarm06.xsigo.com/homes/joeuser/mydebug.txt
joeuser@computefarm06.xsigo.com's password:
Copying...
########################################################################## [100%]
```

Example: Archive and Compress

To create an archive then compress it:

```
file archive -noconfirm foo.tar file1 file2
file compress foo.tar
```

Example: Upload and Download

To upload a file named "`foo.gz`" to `ftp.xsigo.com`:

```
file upload foo.gz
foo.gz
################################################## [100%]
```

To download the file named "`recent_config.xml`":

```
file download recent_config.xml
Downloading...
################################################## [100%]
recent_config.xml
```

Example: Search for Text in a File

To find the text "`foobar`" in the file "`myfile`" and include the line number:

```
file search foobar -linenumbers myfile
15:foobarq
```

Logging

Log files are stored in `/log`.

```
ls /log
lost+found      user.log            osinstall.err            user.log.8.gz
coredumps       user-debug.log      user.log.2.gz            user.log.4.gz
btmp            daemon.log          user.log.3.gz            user.log.5.gz
ulog            lastlog             user-debug.log.2.gz      user.log.6.gz
apache2         kern.log            user-debug.log.3.gz      user.log.9.gz
wtmp            ib.log              user-debug.log.4.gz      osm.log.2.gz
postgresql      postgresql.log      user-debug.log.5.gz      user.log.10.gz
news            createdb.log        user-debug.log.6.gz      user.log.1.gz
ntpstats        osm.log             user-debug.log.7.gz      osm.log.1.gz
ulog-acctd      install.log         user-debug.log.8.gz      user-debug.log.1.gz
ksymoops        apache2.pid         user-debug.log.9.gz
xml             dumpster.log        user-debug.log.10.gz
dmesg           osinstall.out       user.log.7.gz
```

The last bootup data of the chassis is stored in “dmesg”:

```
cat /log/dmesg
```

Standard syslog goes to “user.log”, where log rotation and auto-archive occurs for up to 10 gzipped files:

```
user.log
user.log.1.gz
user.log.2.gz
user.log.3.gz
user.log.4.gz
user.log.5.gz
user.log.6.gz
user.log.7.gz
user.log.8.gz
user.log.9.gz
user.log.10.gz
```

The format of a log message is:

```
<date> <time> <hostname> <module>[<process-id>]: [<msg-level>] <object>::<text-message>
```

Example:

```
Jun  6 00:00:01 iowa vnicmanager[12532]: [ERR] VNIC::VNICManager process_simm_message::
 ENTRY
```

User debugging goes to “user-debug.log” where log rotation also occurs automatically::

```
user-debug.log
user-debug.log.1.gz
user-debug.log.2.gz
user-debug.log.3.gz
user-debug.log.4.gz
user-debug.log.5.gz
user-debug.log.6.gz
user-debug.log.7.gz
user-debug.log.8.gz
user-debug.log.9.gz
user-debug.log.10.gz
```

CHAPTER 4

Configuring the XgOS CLI

This chapter describes commands that configure the XgOS CLI itself or display that configuration. It contains the following sections:

- "Setting CLI Attributes" on page 53
- "Displaying CLI Attributes" on page 56
- "Displaying CLI Output Vertically (Wrapping)" on page 57
- "CLI Display Filters" on page 58
- "Terminal Rows and Columns" on page 60
- "CLI History" on page 61
- "CLI Recording" on page 62
- "Saving and Restoring Configurations" on page 66

Setting CLI Attributes

The `set cli` command configures different attributes of the CLI itself.

Syntax

```
set cli autocommit {off|on} [-noconfirm]
set cli block-entry {off|on}
set cli color {off|on}
set cli cols <number>
set cli rows <number>
set cli confirm {off|on}
set cli echo {off|on}
set cli idle-timeout <minutes>
set cli mode {expert|user|xml}
set cli paging {off|on}
set cli progress-bar {off|on}
set cli prompt {custom <value>|normal}
set cli space-completion {off on}
set cli wrap {off|on}
```

Parameter Description

Parameter	Description
`autocommit {off|on} [-noconfirm]`	The default is on. When a CLI command is complete, the system automatically commits the changes to the configuration database. When set to off, any changes must be manually written to the database using the commit command. The off option is useful for creating a set of changes and then committing them as a group. Autocommit is disabled for ACLs on 10 GE and 10-port GE cards (see add acl).
`block-entry {off| on}`	Controls whether the CLI prompts for the entry of scripting blocks such as “foreach”, etc.
`color {off|on}`	Controls whether the CLI displays colors for command output in a session. Only output is displayed in color. Command prompts and command text is monochrome. By default, colors are displayed, but setting color off returns the screen to monochrome display.
`cols <number>`	Sets the number of columns on the screen. The default is the screen size for your monitor. Setting row size might not be available through a TTY/Console port.
`rows <number>`	Sets the number of rows on the screen. The default is the screen size for your monitor. Setting row size might not be available through a TTY/Console port.
`confirm {off|on}`	Sets the CLI confirmation mode. If the mode is set to on, the CLI confirms dangerous commands.

Parameter	Description
`echo {off|on}`	Displays all CLI communication. The on option will echo all commands to the terminal screen. The default is off.
`idle-timeout <minutes>`	After this many idle minutes, your CLI session will timeout. Configure a value of "0" to configure an infinite CLI timeout (no timeout).
`mode {expert|user|xml}`	Controls the CLI mode. The default is user. See show cli mode.
`paging {off|on}`	Sets the CLI paging mode. When on, the display output stops when the screen is full. When paging mode is off, the output does not stop at the end of the page.
`progress-bar {off|on}`	Determines if a progress bar is displayed on the screen for commands that are expected to take a long time to execute.
`prompt {custom <value>|normal}`	Controls the current CLI prompt mode. The custom keyword sets the prompt to be an arbitrary CLI expression. The normal keyword sets the prompt to be the full name of the current object, such as "admin@chassis[xsigo]".
`space-completion {off|on}`	Controls whether the CLI will complete commands when the space-bar is pressed or not. The default is on.
`wrap {off|on}`	Controls whether the CLI will wrap text at the end of line or not. The default is on.

Example: Controlling Echo on the Command Line

```
set cli echo on
add server-profile foo
add server-profile foo
add server virtual "foo"
top
commit noconfirm
set cli echo off
set cli echo off
add server-profile gogo
```

Displaying CLI Attributes

Use the `show cli` command to display different attributes of the CLI itself.

Syntax

```
show cli autocommit
show cli block-entry
show cli color
show cli cols
show cli command [<name>]
show cli commands [<name>]
show cli confirm
show cli echo
show cli history [<name>]
show cli idle-timeout
show cli keys
show cli loaded-commands
show cli mode
show cli paging
show cli progress-bar
show cli prompt
show cli rows
show cli space-completion
show cli user
show cli wrap
```

Example: Display the CLI Mode

```
show cli mode
user
show cli autocommit
on
```

User mode is the default CLI mode on the system. All CLI commands are auto committed by default.

XgOS CLI Example: Configure the Idle Session Time-out

```
set cli idle-timeout
show cli idle-timeout
The idle timeout is disabled
```

Displaying CLI Output Vertically (Wrapping)

When the terminal display output is too wide and unreadable across the screen, the system can capture the output and display it in vertical mode.

Syntax

```
set cli wrap [off|on]
show cli wrap
```

Example: Control CLI Line Wrapping

```
show iocard
--------------------------------------------------
slot          1
state         up/up
descr
type          sanFc2Port4GbLrCard
v-resources   1
acl
enables       --
```

CLI Display Filters

Display output can be sent through different CLI display filters. By default, the CLI display is controlled automatically by the management terminal settings. However, you can set specific display characteristics by using the XgOS CLI display filters.

Color is also used as an inherent way to help you filter the display output and other pertinent information in the XgOS CLI. For example, color is used for progress bars so that you can easily see when XgOS is busy processing a command or function. Another example of color in the CLI is in confirmation messages. If a message is displayed in red text, that is an indication of either:

- a warning when you are attempting to commit a change, issue a command, perform a reset or complete some other action that will affect the current configuration of the Oracle Fabric Interconnect.
- an error message when a command or function was attempted but was unsuccessful.

Syntax

```
show -list <command>
show -sortby <column>
show -table <command>
show -xml <command>
```

Parameter Description

Parameter	Description
`-list`	Output in list format.
`-sortby`	Column to sort by. It changes the column upon which the table is sorted. Each time a table is printed, there is a default sort column (or columns) by which it is sorted. This default is chosen to be the most common.
`-table`	Output in table format. Table display format is the default.
`-xml`	Output in XML format.

Example: Show Configuration in a List

```
show -list vnic foobar.pubs
-----------------------------------------
name      foobar.pubs
state     up
mac-addr  00:13:97:01:80:06
ipaddr
descr
if        6/1
if-state  -
ha-state
local-id  0
type
vlans     none
qos       ie
```

Example: Show Configuration in XML Format

```
show -xml vnic foobar.pubs
<table>
    <row number="0">
        <cell name="name" value="foobar.pubs"/>
        <cell name="state" value="up/resourceUnavailable"/>
        <cell name="mac-addr" value="00:00:00:00:00:00"/>
        <cell name="ipaddr" value="0.0.0.0/32"/>
        <cell name="if" value=""/>
        <cell name="if-state" value="-"/>
        <cell name="ha-state" value=""/>
        <cell name="local-id" value="0"/>
        <cell name="type" value="dhcp"/>
        <cell name="vlans" value="none"/>
        <cell name="qos" value="ie"/>
    </row>
</table>
```

Example: Sort CLI Output by Columns

To sort the vNIC output by the “if” column:

```
show -sortby=if vnics
```

To specify multiple columns:

```
show -sortby=name,if vnics
```

This command will use “name” as the primary sort and “if” as the secondary.

To perform a reverse sort:

```
show -sortby=!name,if vnics
```

Note – This command is one place in the CLI where command completion is not available.

Terminal Rows and Columns

XgOS enables you to set and display the number of rows and columns for the terminal screen. By default, the number of rows and columns is determined by the terminal size.

Syntax

```
set cli rows <number>
set cli cols <number>
show cli rows
show cli cols
```

Parameter Description

Parameter	Description
`rows`	Number of rows on the terminal screen.
`cols`	Number of columns on the terminal screen.

Example: Set CLI Terminal Screen Rows

```
show cli rows
30
set cli rows 60
show cli rows
60
```

CLI History

Use the `show cli history` command to display the history of issued commands. The history log can be searched using the up/down arrow keys and Ctrl-R command sequence.

Syntax

```
show cli history
show cli history <number>
```

where `<number>` is the number of saved history commands to display. The buffer limit size is 512 commands per user. The log is persistent across CLI login sessions.

Example: Examine CLI History

```
show cli history
35    Wed Jul  4 01:44:01 GMT 2007   show fabric-port
502   Fri Aug 24 01:48:58 GMT 2007   show hardware
503   Fri Aug 24 17:57:04 GMT 2007   set cli idle-timeout 0
504   Fri Aug 24 18:11:23 GMT 2007   show software
505   Fri Aug 24 18:14:25 GMT 2007   show system
506   Fri Aug 24 18:26:19 GMT 2007   telnet fpp
507   Fri Aug 24 18:33:47 GMT 2007   show history
...
```

▼ Search the CLI History

1. **Press Ctrl-R to initiate a history search:**

```
():
```

   Ctrl-C will interrupt the search. Repeated Ctrl-R will display the previous command.

2. **Enter the command text string to search on:**

```
(gogo): add server-profile gogo
```

3. **Press the Enter key to bring the command to the host prompt:**

```
add server-profile gogo
```

CLI Recording

The XgOS CLI contains a command-line recording tool which supports capturing the commands in a management session in the exact sequence in which the commands were issued, then writing that series of commands to a script that you name. After the script is saved, you can then run the script to reproduce the exact set of commands.

Use the `cli record-script` command to start the command-line recording tool, and use the `cli stop-recording` command to stop the recording tool and write the commands to the named script.

```
cli record-script <name>
cli stop-recording
```

When the CLI is being recorded, it behaves as normal, including the display of error or status messages, but the string `xsigo-recording` is inserted in the command prompt to indicate the CLI recording tool is active and recording the current commands.

When the script is run, the command output is displayed, but status and error messages are not displayed. The actual commands logged in the script are also not displayed.

The following example shows a simple script of displaying vNICs. During the CLI recording phase, the commands issued are as follows:

```
show vnic * show
vnic pubstest.sunset
show vnic pubstest.sunset -detail
```

The first part of the example is recording the CLI session and stopping the recording:

```
cli record-script showvnic
Recording CLI commands into the script showvnic.
Use 'cli stop-recording' to end the recording.
# show vnic *
------------------------------------------------------------------
name      iscsitest.pubstest1
state     up/up
mac-addr  02:a0:5c:0f:00:07
ipaddr    192.168.11.119
if        10/1
if-state  up
ha-state
local-id  0
type
vlans     none
qos       --
------------------------------------------------------------------
name      pubstest.sunset
state     up/indeterminate
mac-addr  00:00:00:00:00:00
ipaddr    0.0.0.0/32
if
if-state  -
ha-state
local-id  0
type      dhcp
------------------------------------------------------------------
2 records displayed
------------------------------------------------------------------
# show vnic pubstest.sunset
------------------------------------------------------------------
name      pubstest.sunset
state     up/indeterminate
mac-addr  00:00:00:00:00:00
ipaddr    0.0.0.0/32
if
if-state  -
ha-state
local-id  0
```

```
type      dhcp
vlans     none
qos       --
------------------------------------------------------------
1 record displayed
# show vnic pubstest.sunset -detail
------------------------------------------------------------------------
name            pubstest.sunset
state           up/indeterminate
mac-addr        00:00:00:00:00:00
admin-ipaddr    0.0.0.0/32
oper-ipaddr     0.0.0.0/32
descr
if
if-state        -
mcast-group
type            dhcp
mtu             1500
group
group-pref
ha-state
flags           ----
vlans           none
access-vlan     0
mode            access
queue-map-type  disabled
qos             --
local-id        0
mirror
------------------------------------------------------------------------
1 record displayed
cli stop-recording
Commands have been recorded into a script.  To execute the script
simply type showvnic
```

The final part of this example is running the script:

```
showvnic
------------------------------------------------------------------------
name      iscsitest.pubstest1
state     up/up
mac-addr  02:a0:5c:0f:00:07
ipaddr    192.168.11.119
if        10/1
if-state  up
ha-state
local-id  0
type
```

```
vlans     none
qos       --
------------------------------------------------------------------
name      pubstest.sunset
state     up/indeterminate
mac-addr  00:00:00:00:00
ipaddr    0.0.0.0/32
if
if-state  -
ha-state
local-id  0
type      dhcp
vlans     none
qos       --
------------------------------------------------------------------
-------------
2 records displayed
------------------------------------------------------------------
name      pubstest.sunset
state     up/up
mac-addr  00:00:00:00:00:00
ipaddr    0.0.0.0/32
if
if-state  -
ha-state
local-id  0
type      dhcp
vlans     none
qos       --
------------------------------------------------------------------
1 record displayed
------------------------------------------------------------------
name            pubstest.sunset
state           up/indeterminate
mac-addr        00:00:00:00:00:00
admin-ipaddr    0.0.0.0/32
oper-ipaddr     0.0.0.0/32
descr
if
if-state        -
mcast-group
type            dhcp
mtu             1500
group
group-pref
ha-state
flags           ----
vlans           none
access-vlan     0
```

```
mode             access
queue-map-type   disabled
qos              --
local-id         0
mirror
------------------------------------------------------------------
1 record displayed
```

Saving and Restoring Configurations

Before you perform a firmware upgrade in XgOS, Oracle recommends you export your system configuration to a file. If your running-config gets lost during an upgrade, at least you can import a saved config. If you import a configuration, the system migrates the old config to the new.

See "System Image Upgrades" on page 313 for details on how to upgrade a software image.

Syntax

```
system export <filename> [-defaults]
system import <filename>
```

Parameter Description

Parameter	Description
`export <filename> [-defaults]`	Exports the running-config to a file. The file is saved as XML format. As an option, you can use `-defaults` to include properties with default values in the exported config.
`import <filename>`	Loads a configuration file into the system. If you import a configuration, the system migrates the old config to the new. The file is imported in XML format. As an option, you can use `-defaults` to include properties with default values in the imported config.

Example: Save and Restore System Configuration

```
system export myconfig.xml
system import myconfig.xml

DISK STATUS
Partition              Size  Available       Used %used
Base OS           253.967M    77.037M   163.816M  64%  |#############--------|
XgOS                1.192G   330.699M   827.602M  67%  |###############-------|
System logs         9.169G     8.531G   175.754M   1%  |----------------------|
Database            8.249G     7.646G   188.738M   2%  |----------------------|
Temporary data      6.040G     5.701G    32.062M   0%  |----------------------|
User data           2.752G     2.522G    92.645M   3%  |----------------------|
Volatile data     184.901M   175.334M     0.021M   0%  |----------------------|
Config data        44.292M    41.952M     0.053M   0%  |----------------------|
```

The `-xml` option is the default behavior. You can omit it.

CHAPTER 5

Server Profiles and Gateways

This chapter describes how to configure the Oracle server profiles and the default gateway.

- "Server Profiles" on page 69
- "Default Gateway" on page 72

Server Profiles

A server profile is a logical representation of a physical host server's I/O configuration which can be assigned to a physical server. When you assign a server profile, the host server assumes all of the server profile's I/O characteristics.

Server profiles, like most objects in the Oracle Fabric Interconnect, have "Naming Conventions" on page 8.

Syntax

```
add server-profile <name> <physical-server>
add server-profile <name> <physical-server>
add server-profile {*|<name>} connection <physical-server> -descr="<text>"
set server-profile {*|<name>} connect <physical-server>
set server-profile {*|<name>} disconnect
set server-profile {*|<name>} down
set server-profile <name> iscsi-boot [<vnic>|none] <targetIP>
    [mount {direct </dev/node>|LABEL=<label>|lvm <group-name> <volume-name>}]
set server-profile {*|<name>} reset
set server-profile {*|<name>} san-boot [<vhba>|none] <wwpn> <wwnn>
    [mount {direct <device-name>|LABEL=<label>|lvm <group> <volume>}]
set server-profile {*|<name>} up
set server-profile {*|<name>} -default-gateway=<name>|none
set server-profile {*|<name>} -descr="<text>"
set server-profile {*|<name>} -phone-home-enabled=[default] [true] [false]
set server-profile {*|<name>} -san-boot-role=[default][load][loadmount]
    [mount][none]
remove server-profile <name>
remove server-profile <name> [vhbas][vnics][-noconfirm]
show server-profile <name>
show server-profile <name> [alarms][connection][errors][throughput][san-boot]
    [vhbas][vnics][warnings]
```

Parameter Descriptions

Parameter	Description
<name>	Name the server profile something unique to this Oracle Fabric Interconnect. A server profile name must be between 1 and 32 characters. Restrict characters in the name to alphanumerics, the dash (-), and the underscore (_).
<physical-server>	The name of a server connected to the Oracle Fabric Interconnect.
connection	Sets the properties of the connection to the server.
connect	Connects the server profile to the specified server.
disconnect	Disconnects the server profile from the server.
down	Sets the server profile administratively down.
iscsi-boot	Configures the iSCSI boot options for this server profile. For details about the set server-profile iscsi-boot command, refer to the *XgOS Remote Booting Guide*.

Parameter	Description
reset	Resets the busy state.
san-boot	Configures the SAN boot options for this server profile. For details about the set server-profile san-boot command, refer to the XgOS *Remote Booting Guide*.
up	Sets the server profile administratively up.

Optional Modifiers

Modifier	Description
`-default=gateway=<name>`	The name of a default gateway that you have already configured. For details about configuring a default gateway, see "Default Gateway" on page 72.
`-descr="text"`	An optional description of the server profile. This description is entirely for your own use. If the description includes spaces, be sure to enclose the entire description in quotation marks.
`-phone-home-enabled`	Allows you to enable and disable the state of Xsigo ProWatch (phone home) on a per-Server Profile basis. For more information about Xsigo ProWatch (phone home), see "Xsigo ProWatch Overview" on page 291.
`-san-boot-role`	Allows you to set or change the role for a SAN Boot Server Profile. For information about SAN Boot, refer to the *XgOS Remote Booting Guide*.

▼ Create a Server Profile

Take the following steps to create a server profile:

1. Add a server profile named mytest:

```
add server-profile mytest ?
Possible completions:
  alexander@iowa:ServerPort8  Connection to host alexander (up)
  ceasar@iowa:ServerPort24    Connection to host ceasar (up)
```

All the physical servers connected to the Oracle Fabric Interconnect are displayed. The two servers listed (alexander and caesar) were automatically discovered by the Oracle Fabric Interconnect.

2. **Select the desired server and create the server profile:**

```
add server-profile mytest alexander@iowa:ServerPort8
```

3. **Verify the profile was created correctly:**

```
show server-profile mytest
name    state          descr                    connection  def-gw  vnics  vhbas
-------------------------------------------------------------------------------
mytest  up/unassigned  My first server profile                    1      1
1 record displayed
```

No I/O resources (vNICs or vHBAs) have been assigned to the new server profile. Resources will be assigned to the profile in the following sections (See "Virtual Network Interface Cards (vNICs)" on page 77 and "Virtual Host Bus Adapters (vHBAs)" on page 133.)

If the state displays "unassigned", then the profile is created but not yet assigned to an actual host server. Use `set server-profile <name> connect <phys-server>` for the assignment.

If your server uses dual-port HCAs, do not assign the same server profile to both ports. Having the same profile assigned to the same server twice can cause unpredictable behavior.

Default Gateway

Define a default gateway on a server profile to enable IP communication with hosts on different IP subnets. This feature enables centralized IP address administration from the Oracle Fabric Interconnect. Given this feature, a default gateway need not be configured directly on a host.

Note – The default gateway feature is not yet supported for a Windows server 64-bit platform host. However, a Windows 32-bit host does support the default gateway feature. Also, due to the current implementation of subnet matching on the Oracle Fabric Interconnect, the default gateway's IP subnet must match the subnet of at least one vNIC configured in the same server profile.

Syntax

```
add gateway <gw-name> <ip-addr> <dns> <domain-name> [-noconfirm]
set gateway <gw-name> [-descr="text"][-dns=<dns-addr>][-domain-name=<name>]
   [-ipaddr=<addr>]
set server-profile <name> -default-gateway=[<gw-name>][none]
show gateway [<name>] {server-profiles]
remove gateway [<name>] [-noconfirm]
```

Parameter Descriptions

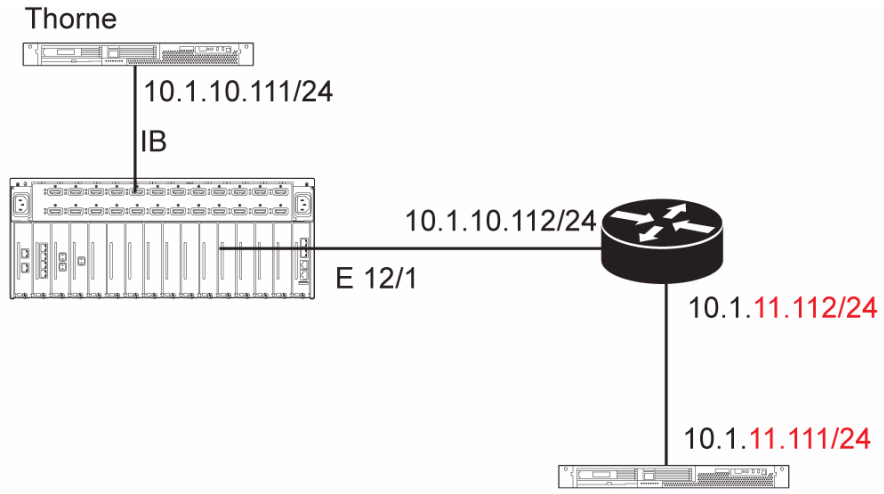
Parameter	Description
<gw-name>	Name the gateway something unique to this Oracle Fabric Interconnect. Restrict characters in the name to alphanumerics, the dash (-), and the underscore (_).
<ip-addr>	The IP address of the gateway.
<dns>	The IP address of the DNS server.
<domain-name>	The Internet domain name of the gateway.

Optional Modifiers

Modifier	Description
-descr="text"	An optional description of the gateway. This description is entirely for your own use. If the description includes spaces, be sure to enclose the entire description in quotation marks.

▼ Configure a Default Gateway

The following figure shows the topology of a default gateway.



Take the following steps to configure a default gateway:

1. **From the hostserver, confirm the following entities are not reachable: default gateway address, DNS server address, and domain name.**

```
cat /etc/resolv.conf
route
ping 10.1.11.112
```

2. **Issue the `route` command to confirm the server cannot reach the outside network because you have not yet configured a default gateway.**

   Likewise ping 10.1.11.112 will fail in this example because the route is not yet installed in the routing table.

3. **On the Oracle Fabric Interconnect, add a server profile and vNIC:**

```
add server-profile s23 thorne@connecticut:ServerPort22
add vnic test_1.s23 8/1
set vnic test_1.s23 -addr-type=static -ip-addr=10.1.10.111/24
```

4. **Create a default-gateway profile. Specify the gateway-profile name, default gateway IP address, DNS server IP address, and domain name:**

```
add gateway test 10.1.10.112 1.1.1.1 testorg
show gateway test
```

```
name      descr      addr           dns-addr      domain-name
-------------------------------------------------------------------
test                 10.1.10.112      1.1.1.1       testorg
```

Note – The gateway's IP address must be on the same subnet as the vNIC's address.

5. **Associate the default-gateway profile with the server profile:**

```
set server-profile s23 -default-gateway=test
show server-profile s23

name  state  descr  connection                 def-gw  vnics  vhbas
-------------------------------------------------------------------
s23   up/up       thorne@connecticut:ServerPort22  test   1     0
```

6. **On the hostserver, verify the default gateway and DNS server were pushed to the hostserver and installed properly:**

```
cat /etc/resolv.conf
route
ping 10.1.11.112
```

▼ Change a Gateway's Configuration

To modify an existing default-gateway profile:

1. **Use the** `none` **option to disassociate the default-gateway profile with the Oracle server profile:**

```
set server-profile s23 -default-gateway=none
```

2. **Note all the gateway options you can change:**

```
set gateway test ?
Possible completions:
  [Optional qualifiers]
    -descr        Description
    -dns          IP address of DNS server
    -domain-name  Internet domain name
    -ipaddr       IP address of default gateway
```

This example changes the DNS to 2.2.2.2. After the change is made, the default-gateway profile must be reassociated back to the server profile:

```
set gateway test -dns=2.2.2.2
set server-profile s23 -default-gateway=test
show gateway test
name      descr      addr            dns-addr      domain-name
-------------------------------------------------------------------
test                  10.1.10.112       2.2.2.2        testorg
```

CHAPTER 6

Virtual Network Interface Cards (vNICs)

The Oracle virtual Network Interface Card (vNIC) virtualizes NIC connectivity. A vNIC is a virtual NIC that appears to the OS as a physical NIC and enables a server to have a Ethernet network attachment without having a physical NIC present. Instead of the client server using an NIC, an InfiniBand (IB) HCA is used and then virtualizes the NIC allowing for Ethernet connectivity.

This chapter explains how to configure vNICs in the following sections:

- "Basic vNIC Configuration" on page 78
- "vNIC Counters and Statistics" on page 80
- "High Availability vNIC Pairs" on page 81
- "Automatic Switchover" on page 88
- "Admin State Control" on page 90
- "Gigabit Ethernet Card State" on page 91
- "Gigabit Ethernet Port State" on page 92
- "Maximum Transmission Unit" on page 94
- "vNIC Mirroring" on page 96
- "Controlling IGMP Delayed Leaves" on page 106
- "Setting Allowed VLANs Per vNIC" on page 108
- "TCP Segmentation Offload" on page 111
- "Receive Batching" on page 114

To enable vNICs for VMware environments, see "VMware ESX Servers" on page 179. To enable vNICs for QoS, see "Network QoS for vNICs" on page 191.

Virtual NICs, like most objects in the Oracle Fabric Interconnect, have "Naming Conventions" on page 8.

Basic vNIC Configuration

A vNIC involves the following bringup procedure:

- Adding a server profile
- Creating a named vNIC
- Associating the vNIC to a server profile and physical I/O card
- Setting IP address information
- Verifying the configuration and state

Syntax

```
add server-profile <name> <server>@<f1-15>:ServerPort<ib-port-num>
add vnic <vnic-name>.<server-profile-name> {<slot>/<port>|none}
set vnic <vnic-name>.<server-profile-name> -addr-type=[default|static|dhcp]
    -ip-addr=<addr/mask> -ipaddr-host-managed=<n.n.n.n>
set vnic <vnic-name>.<server-old> move <vnic-name>.<server-new>
remove vnic {*|<vnic-name>} [-noconfirm]
show vnic [*] [<vnic-name>] [-detail]
show vnic <vnic-name>.<server-name> vnic-stats
```

Parameter Description

Parameter	Description
`add server-profile <server-name> <actual-physcon>`	Creates a named server <server-name> and associates it with the actual hostname (<actual-physcon>) associated with the resource. This hostname is also known as the physical connection (phys-con). Once a server-profile is added, you can add subsequent vNICs (`add vnic`) to it.
`add vnic <vnic-name>.<server-profile-name> <slot>/<port>`	Creates a named vNIC, associates it with a server name, and specifies a physical slot/port on the chassis. A 10GigE I/O card can support 128 vNICs.
`set vnic <vnic-name>.<server-profile-name> -addr-type=[default|static|dhcp] -ip-addr=<address/mask> -ipaddr-host-managed=<n.n.n.n>`	Configures an IP address on the named vNIC. The address type can be static or dhcp assigned. The default is dhcp.

Note – The Oracle Fabric Interconnect automatically assigns MAC addresses to vNICs from a pool of internal-sequential addresses.

Example: Configure a Server Profile With a vNIC

```
add server-profile myserver alexander@iowa:ServerPort8
add vnic myvinc.myserver 4/2
set vnic myvinc.myserver -addr-type=static -ip-addr=10.1.1.1/32
show vnic myvinc.myserver
------------------------------------------------------------------
name      myvinc.myserver
state     up
mac-addr  00:13:97:01:80:08
ipaddr    10.1.1.1/32
descr
if        4/2
if-state  up
type      static
vlans     none
qos       --
show ioport 4/2 -detail
------------------------------------------------------------------
name           4/2
type           nwEthernet1GbPort
state          up/up
descr
rate           auto/1Gbps
mtu            1500
avail-in-cir   0Kbps
avail-out-cir  1Gbps
mode           access
flags          -s-
lag
access-vlan    1
vnics          3
vlans          none
------------------------------------------------------------------
1 record displayed
show vnic myvinc.myserver vnic-stats
------------------------------------------------------------------
name                 myvinc.myserver
vlan-id-or-none      0
rcv-pkt              0
```

```
rcv-bytes             0
trans-pkt             0
trans-bytes           0
invalid-ip-checksum   ?
invalid-l4-checksum   ?
mtu-err               ?
ipchecksum-pkt        ?
tcp-checksum-pkt      ?
udp-checksum-pkt      ?
tcpseg-pkt            ?
green-pkt             ?
yellow-pkt            ?
red-pkt               ?
-------------------------------------------------------------------
1 record displayed
```

vNIC Counters and Statistics

There are several ways to gather vNIC counters and statistics.

On the host server:

ifconfig <vnic-name>	Displays statistics as collected by the OS through the network layer.
cat /proc/driver/vnic/devices/<vnic-name>	Shows stats as collected by the vNIC driver.
/opt/xsigo/bin/xsigo-support	Collects and dumps information for monitoring and troubleshooting your host-software installation.

On the Oracle Fabric Interconnect:

```
show vnic <vnic-name> [<wildcard>] [throughput]
show vnic <vnic-name> vnic-stats
set vnic <vnic-name>.<server-name> clear [igmp-stats][vnic-stats]
```

Use these commands to display and clear statistics as collected by the vNIC statistics model in the chassis.

High Availability vNIC Pairs

High availability (HA) vNIC pairs can be configured for a single Oracle Fabric Interconnect chassis, or for two separate Oracle Fabric Interconnects.

The system does not support the dynamic reconfiguration of vNIC failover characteristics. Once you create an HA enabled vNIC, the system does not allow you to change its failover characteristics. You must delete the vNIC then create a new one from scratch.

Also, when you configure an HA vNIC, the configuration of each vNIC in the HA pair must be the same.

Note – If you are using VMware ESX Server, HA vNIC support is handled through NIC Teaming. Use the VMware Infrastructure Client to configure a teamed pair of vNICs. These two network interfaces attach to the same vSwitch. Do not use Xsigo HA vNIC configurations if you are using ESX Server.

▼ Configure a Single Chassis

This section documents an example of configuring HA within a single Oracle Fabric Interconnect.

1. **Create a vNIC called "haNIC1" and assign it to a server profile "vserver1":**

   All of the available physical Ethernet cards are displayed.

```
add vnic haNIC1.vserver1 ?
Possible completions:
  6/1 nwEthernet1GbPort in slot 6 port 1
  6/2 nwEthernet1GbPort in slot 6 port 2
  6/3 nwEthernet1GbPort in slot 6 port 3
  6/4 nwEthernet1GbPort in slot 6 port 4
  6/5 nwEthernet1GbPort in slot 6 port 5
  6/6 nwEthernet1GbPort in slot 6 port 6
  6/7 nwEthernet1GbPort in slot 6 port 7
  6/8 nwEthernet1GbPort in slot 6 port 8
  6/9 nwEthernet1GbPort in slot 6 port 9
  6/10 nwEthernet1GbPort in slot 6 port 10
  8/1 nwEthernet1GbPort in slot 8 port 1
  8/2 nwEthernet1GbPort in slot 8 port 2
  8/3 nwEthernet1GbPort in slot 8 port 3
  8/4 nwEthernet1GbPort in slot 8 port 4
```

```
  8/5 nwEthernet1GbPort in slot 8 port 5
  8/6 nwEthernet1GbPort in slot 8 port 6
  8/7 nwEthernet1GbPort in slot 8 port 7
  8/8 nwEthernet1GbPort in slot 8 port 8
  8/9 nwEthernet1GbPort in slot 8 port 9
  8/10 nwEthernet1GbPort in slot 8 port 10
```

2. **Bind the vNIC to a physical Ethernet card.**

3. **Select the slot/port that you want to link to the vNIC (in this example, "6/1"):**

```
add vnic haNIC1.vserver1 6/1 ?
Possible completions:
  ha  Specify High Availability characteristics
```

4. **Specify the primary vNIC of the high-availability pair by selecting** `ha`**.**

   The first vNIC created and designated as `ha` automatically becomes the primary vNIC of the pair:

```
add vnic haNIC1.vserver1 6/1 ha ?
Possible completions:
  6/1          nwEthernet1GbPort in slot 6 port 1 (down)
  6/2          nwEthernet1GbPort in slot 6 port 2 (down)
  6/3          nwEthernet1GbPort in slot 6 port 3 (down)
  6/4          nwEthernet1GbPort in slot 6 port 4 (down)
  6/5          nwEthernet1GbPort in slot 6 port 5 (down)
  6/6          nwEthernet1GbPort in slot 6 port 6 (down)
  6/7          nwEthernet1GbPort in slot 6 port 7 (down)
  6/8          nwEthernet1GbPort in slot 6 port 8 (down)
  6/9          nwEthernet1GbPort in slot 6 port 9 (down)
  6/10         nwEthernet1GbPort in slot 6 port 10 (down)
[Optional qualifiers]
  -mac         Secondary HA group MAC address
  -primary     This is a primary HA VNIC
  -secondary   This is a secondary HA VNIC (need to
               specify group MAC address)
```

5. **Bind the secondary vNIC to a physical Ethernet card.**

6. **Select the slot/port that you want to link to the secondary vNIC (in this example, "6/3"), then press Enter.**

Note – Do not select the same slot/port that was assigned to the primary vNIC.

```
add vnic haNIC1.vserver1 6/1 ha 6/3
```

This command set created a high-availability vNIC pair on a single chassis. The primary vNIC is named `haNIC1`. The secondary vNIC was created automatically and named `haNIC1S`. (Note the "S" appended to the end of the name.) The full name of the primary vNIC was automatically assigned as the high-availability group's name.

▼ Configure Multiple Chassis

This section documents an example of configuring HA across multiple Oracle Fabric Interconnects.

Note – Be aware that for Windows HA vNICs, the primary vNIC from one chassis and secondary vNIC from the second chassis must have always same vNIC name and Server Profile name. The secondary vNIC names are not automatically generated, so make sure that you use the same vNIC name and Server profile name when you create multi-chassis HA vNICs for a Windows server.

1. **Log into the first Oracle Fabric Interconnect chassis.**

   a. **Create a vNIC.**

   b. **Add a vNIC, called `haNIC1`, and assign it to a server profile "`vserver1`":**

```
add vnic haNIC1.vserver1 ?
Possible completions:
  6/1         nwEthernet1GbPort in slot 6 port 1 (down)
  6/2         nwEthernet1GbPort in slot 6 port 2 (down)
  6/3         nwEthernet1GbPort in slot 6 port 3 (down)
  6/4         nwEthernet1GbPort in slot 6 port 4 (down)
  6/5         nwEthernet1GbPort in slot 6 port 5 (down)
  6/6         nwEthernet1GbPort in slot 6 port 6 (down)
  6/7         nwEthernet1GbPort in slot 6 port 7 (down)
  6/8         nwEthernet1GbPort in slot 6 port 8 (down)
  6/9         nwEthernet1GbPort in slot 6 port 9 (down)
  6/10        nwEthernet1GbPort in slot 6 port 10 (down)
  8/1         nwEthernet1GbPort in slot 8 port 1
  8/2         nwEthernet1GbPort in slot 8 port 2
  8/3         nwEthernet1GbPort in slot 8 port 3
  8/4         nwEthernet1GbPort in slot 8 port 4
```

```
  8/5         nwEthernet1GbPort in slot 8 port 5
  8/6         nwEthernet1GbPort in slot 8 port 6
  8/7         nwEthernet1GbPort in slot 8 port 7
  8/8         nwEthernet1GbPort in slot 8 port 8
  8/9         nwEthernet1GbPort in slot 8 port 9
  8/10        nwEthernet1GbPort in slot 8 port 10
```

c. Bind the vNIC to a physical Ethernet card.

d. Select the slot/port that you want to link to the vNIC (in this example, "6/1"):

```
add vnic haNIC1.vserver1 6/1 ?
```

A single option is displayed that enables you to configure the new vNIC as half of a high-availability vNIC pair.

```
Possible completions:
  ha  Specify High Availability characteristics
```

e. Configure the vNIC as half of a high-availability pair. Enter "`ha`**":**

```
add vnic haNIC1.vserver1 6/1 ha ?
Possible completions:
  6/1     nwEthernet1GbPort in slot 6 port 1 (down)
  6/2     nwEthernet1GbPort in slot 6 port 2 (down)
  6/3     nwEthernet1GbPort in slot 6 port 3 (down)
  6/4     nwEthernet1GbPort in slot 6 port 4 (down)
  6/5     nwEthernet1GbPort in slot 6 port 5 (down)
  6/6     nwEthernet1GbPort in slot 6 port 6 (down)
  6/7     nwEthernet1GbPort in slot 6 port 7 (down)
  6/8     nwEthernet1GbPort in slot 6 port 8 (down)
  6/9     nwEthernet1GbPort in slot 6 port 9 (down)
  6/10    nwEthernet1GbPort in slot 6 port 10 (down)
  8/1     nwEthernet1GbPort in slot 8 port 1
  8/2     nwEthernet1GbPort in slot 8 port 2
  8/3     nwEthernet1GbPort in slot 8 port 3
  8/4     nwEthernet1GbPort in slot 8 port 4
  8/5     nwEthernet1GbPort in slot 8 port 5
  8/6     nwEthernet1GbPort in slot 8 port 6
  8/7     nwEthernet1GbPort in slot 8 port 7
  8/8     nwEthernet1GbPort in slot 8 port 8
  8/9     nwEthernet1GbPort in slot 8 port 9
  8/10    nwEthernet1GbPort in slot 8 port 10
[Optional qualifiers]
-mac        Secondary HA group MAC address
-primary    This is a primary HA VNIC
-secondary  This is a secondary HA VNIC (need to
            specify group MAC address)
```

f. Configure the vNIC as the primary vNIC of the HA pair.

g. Select "-primary", then press Enter.

```
add vnic haNIC1.vserver1 6/1 ha -primary
```

This command set created a vNIC (haNIC1), assigned it to a server profile (vserver1), bound it to a physical slot/port (6/1), and specified the vNIC as the primary vNIC in a high-availability vNIC pair.

h. Retrieve the MAC address of the primary vNIC.

```
show vnic haNIC1.vserver
-----------------------------------------
name          haNIC1.vserver1
state         resourceUnavailable
mac-addr      00:13:97:01:80:01
ipaddr
descr
if            6/1
mcast-group
type
mtu           1500
group         haNIC1.vserver1
group-pref    primary
flags
vlans         none
-----------------------------------------
```

2. Log into the second Oracle Fabric Interconnect chassis.

a. Create a second vNIC.

Add a second vNIC, give it the same name as the primary vNIC ("haNIC1"), and assign it to the same server profile as the primary vNIC ("vserver1").

```
add vnic haNIC1.vserver1 ?
Possible completions:
  6/1     nwEthernet1GbPort in slot 6 port 1 (down)
  6/2     nwEthernet1GbPort in slot 6 port 2 (down)
  6/3     nwEthernet1GbPort in slot 6 port 3 (down)
  6/4     nwEthernet1GbPort in slot 6 port 4 (down)
  6/5     nwEthernet1GbPort in slot 6 port 5 (down)
  6/6     nwEthernet1GbPort in slot 6 port 6 (down)
  6/7     nwEthernet1GbPort in slot 6 port 7 (down)
  6/8     nwEthernet1GbPort in slot 6 port 8 (down)
  6/9     nwEthernet1GbPort in slot 6 port 9 (down)
  6/10    nwEthernet1GbPort in slot 6 port 10 (down)
  8/1     nwEthernet1GbPort in slot 8 port 1
```

```
  8/2     nwEthernet1GbPort in slot 8 port 2
  8/3     nwEthernet1GbPort in slot 8 port 3
  8/4     nwEthernet1GbPort in slot 8 port 4
  8/5     nwEthernet1GbPort in slot 8 port 5
  8/6     nwEthernet1GbPort in slot 8 port 6
  8/7     nwEthernet1GbPort in slot 8 port 7
  8/8     nwEthernet1GbPort in slot 8 port 8
  8/9     nwEthernet1GbPort in slot 8 port 9
  8/10    nwEthernet1GbPort in slot 8 port 10
```

b. Bind the second vNIC to a physical Ethernet card on the second chassis.

c. Select the slot/port that you want to link to the secondary vNIC (in this example, "`8/2`"):

```
add vnic haNIC1.vserver1 8/2 ?
```

A single option is displayed which enables you to configure the new vNIC as one half of a high-availability vNIC pair.

```
Possible completions:
  ha  Specify High Availability characteristics
```

d. Configure the second vNIC as the second half of a high-availability pair. Enter "`ha`":

```
add vnic haNIC1.vserver1 8/2 ha ?
Possible completions:
  6/1     nwEthernet1GbPort in slot 6 port 1 (down)
  6/2     nwEthernet1GbPort in slot 6 port 2 (down)
  6/3     nwEthernet1GbPort in slot 6 port 3 (down)
  6/4     nwEthernet1GbPort in slot 6 port 4 (down)
  6/5     nwEthernet1GbPort in slot 6 port 5 (down)
  6/6     nwEthernet1GbPort in slot 6 port 6 (down)
  6/7     nwEthernet1GbPort in slot 6 port 7 (down)
  6/8     nwEthernet1GbPort in slot 6 port 8 (down)
  6/9     nwEthernet1GbPort in slot 6 port 9 (down)
  6/10    nwEthernet1GbPort in slot 6 port 10 (down)
  8/1     nwEthernet1GbPort in slot 8 port 1
  8/2     nwEthernet1GbPort in slot 8 port 2
  8/3     nwEthernet1GbPort in slot 8 port 3
  8/4     nwEthernet1GbPort in slot 8 port 4
  8/5     nwEthernet1GbPort in slot 8 port 5
  8/6     nwEthernet1GbPort in slot 8 port 6
  8/7     nwEthernet1GbPort in slot 8 port 7
  8/8     nwEthernet1GbPort in slot 8 port 8
  8/9     nwEthernet1GbPort in slot 8 port 9
  8/10    nwEthernet1GbPort in slot 8 port 10
```

```
[Optional qualifiers]
-mac         Secondary HA group MAC address
-primary     This is a primary HA VNIC
-secondary   This is a secondary HA VNIC (need to specify group
             MAC address)
```

3. Configure the second vNIC as the secondary vNIC of the high-availability pair.

```
[Optional qualifiers]
-mac         Secondary HA group MAC address
-primary     This is a primary HA VNIC
-secondary   This is a secondary HA VNIC (need to specify group
             MAC address)
```

Select "`-secondary`" then press Enter:

```
add vnic haNIC1.vserver1 8/2 ha -secondary ?
Possible completions:
  6/1      nwEthernet1GbPort in slot 6 port 1 (down)
  6/2      nwEthernet1GbPort in slot 6 port 2 (down)
  6/3      nwEthernet1GbPort in slot 6 port 3 (down)
  6/4      nwEthernet1GbPort in slot 6 port 4 (down)
  6/5      nwEthernet1GbPort in slot 6 port 5 (down)
  6/6      nwEthernet1GbPort in slot 6 port 6 (down)
  6/7      nwEthernet1GbPort in slot 6 port 7 (down)
  6/8      nwEthernet1GbPort in slot 6 port 8 (down)
  6/9      nwEthernet1GbPort in slot 6 port 9 (down)
  6/10     nwEthernet1GbPort in slot 6 port 10 (down)
  8/1      nwEthernet1GbPort in slot 8 port 1
  8/2      nwEthernet1GbPort in slot 8 port 2
  8/3      nwEthernet1GbPort in slot 8 port 3
  8/4      nwEthernet1GbPort in slot 8 port 4
  8/5      nwEthernet1GbPort in slot 8 port 5
  8/6      nwEthernet1GbPort in slot 8 port 6
  8/7      nwEthernet1GbPort in slot 8 port 7
  8/8      nwEthernet1GbPort in slot 8 port 8
  8/9      nwEthernet1GbPort in slot 8 port 9
  8/10     nwEthernet1GbPort in slot 8 port 10
[Optional qualifiers]
-mac         Secondary HA group MAC address
-primary     This is a primary HA VNIC
-secondary   This is a secondary HA VNIC (need to specify group
             MAC address)
```

Note – Automatic Switchover is appropriate for cases where traffic engineering requires that a specific vNIC always be used for network communication.

---

4. **Insert the primary vNIC's MAC address.**

   a. **Select "`-mac`".**

   b. **Type '`<space>`', enter the MAC address retrieved in Step 6, then press Enter.**

```
add vnic haNIC1.vserver1 8/2 ha -secondary -mac=00:13:97:01:80:01
```

This command set created a high-availability vNIC pair across two Oracle Fabric Interconnects. The HA group's name was automatically set to `haNIC1.vserver1`. Both the primary and secondary vNICs are named `haNIC1`.

Automatic Switchover

Automatic switchover enables a vNIC to revert back to a primary path after it's restored (comes back online). When `auto-switchover` is not configured, a vNIC remains on the secondary path and never reverts back to primary (default).

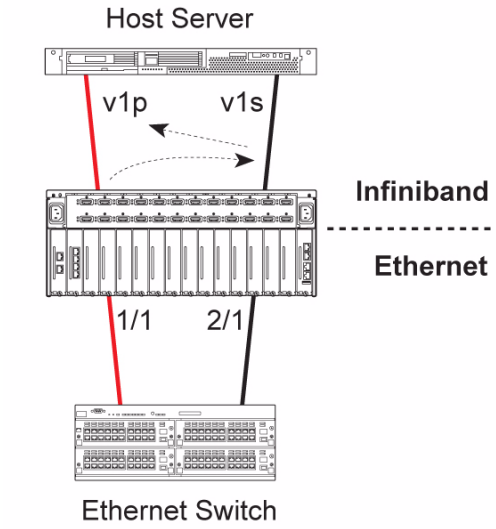
Syntax

```
add vnic <name>.<profile> <pri-s/p> -auto-switchover=true ha <sec-s/p>
show vnic <name>.<profile> -detail
```

Default: automatic switchover is disabled.

Example: Configure Automatic Switchover

Card 1/1 is the primary link for a vNIC named test_1.01bardeen. The secondary link connects to card 2/1.



When 1/1 goes down, traffic fails over to path 2/1. When 1/1 comes back online, the vNIC reverts back to using 1/1 automatically. Any failure along the path (Ethernet or InfiniBand) of the vNIC will force traffic flow to the other side.

Note that `show vnic -detail` displays "flags" is set to "A" once -auto-switchover is enabled:

```
add vnic test_1.01bardeen 1/1 -auto-switchover=true ha 2/1
show vnic test_1.01bardeen -detail
------------------------------------------------------------------
name             test_1.01bardeen
state            up
mac-addr         00:13:97:01:80:09
admin-ipaddr
oper-ipaddr
descr
if               1/1
if-state         up
mcast-group
type
mtu              1500
group            test_1.01bardeen
group-pref       primary
ha-state         active
flags            A
vlans            none
access-vlan      1
mode             access
queue-map-type   disabled
```

```
qos             --
local-id        0
-------------------------------------------------------------------
1 record displayed
```

Admin State Control

Use `set vnic up|down` to control the administrative state of a configured vNIC.

Syntax

```
set vnic <vnic-name>.<server-name> up
set vnic <vnic-name>.<server-name> down
```

Parameter Description

Parameter	Description
up	Activates a vNIC (default)
down	Deactivates a vNIC

Example: Display and Control vNICs

```
show vnic myvnic.myserver
-------------------------------------------------------------------
name       myvnic.myserver
state      up/up
mac-addr   00:13:97:01:80:06
ipaddr
if         4/2
if-state   up
ha-state
local-id
type
vlans      none
```

```
qos       --
------------------------------------------------------------------
1 record displayed
set vnic myvnic.myserver down
Deactivating a VNIC will cause the network interface on the server
to become inoperable. Are you sure you want to deactivate VNIC
boofar.pubs2 (y/n)?y
show vnic myvnic.myserver
------------------------------------------------------------------
name      myvnic.myserver
state     down/down
mac-addr  00:13:97:01:80:06
ipaddr
if        4/2
if-state  up
ha-state
local-id
type
vlans     none
qos       --
------------------------------------------------------------------
1 record displayed
```

Gigabit Ethernet Card State

Use the `show ethernet-card` command to display information about the Gigabit Ethernet module on which the vNICs are terminated.

```
show ethernet-card <slot>|* acl-flows [-detail]
show ethernet-card <slot>|* acl-stats [-detail]
show ethernet-card <slot>|* alarms [-detail]
show ethernet-card <slot>|* dmesg [-detail]
show ethernet-card <slot>|* errors [-detail]
show ethernet-card <slot>|* ioport [-detail]
show ethernet-card <slot>|* ioports [-detail]
show ethernet-card <slot>|* mac-table [-detail]
show ethernet-card <slot>|* qos [-detail]
show ethernet-card <slot>|* stats [-detail]
show ethernet-card <slot>|* utilization [-detail]
show ethernet-card <slot>|* vhbas [-detail]
show ethernet-card <slot>|* vnics [-detail]
show ethernet-card <slot>|* warnings [-detail]
watch ethernet-card <slot>
```

Example: Show Ethernet Card Utilization

In the following example, the `show ethernet-card utilization` command is issued against a 10-Port GE module in slot 14.

```
show ethernet-card 14 utilization
name     total-util     server-util     network-util     bcast-util
------------------------------------------------------------------
14         0                0                0                 0
1 record displayed
```

The command shows columns for different types of utilization for the card:

- Total utilization, which is the sum of all the other columns.
- Server utilization, the total amount of traffic that is transmitted to or received from the server
- Network utilization, the total amount of traffic that is passing through the card transmitted to or received from the network.
- Broadcast utilization, the total amount of broadcast traffic that is being processed by the card.

Example: Watch an Ethernet Card

In the following example, the `watch` command is issued against a 10-Port GE module in slot 14.

```
watch ethernet-card 14
IOCard measured in bytes                          Wed Jul 13 09:20:37 PDT 2011
name  type                          state  rate  util  rate-stats  util-stats
-------------------------------------------------------------------
14    nwEthernet10Port1GbCardEthIb  up     0     0
1 record displayed
```

Gigabit Ethernet Port State

Use the `show ethernet-port` command to display information about the Gigabit Ethernet module on which the vNICs are terminated.

```
show ethernet-port <port>/<slot> alarms
show ethernet-port <port>/<slot> qos
show ethernet-port <port>/<slot> stats
```

```
show ethernet-port <port>/<slot> vlan-association
show ethernet-port <port>/<slot> vnics
watch ethernet-port <port>/<slot>
watch ethernet-ports
```

Example: Show an Ethernet Port

In the following example, the `show ethernet-port` command is issued against port 1 of the card in slot 14.

```
show ethernet-port 14/1
name type              state descr     mode  flags lag access-vlan vnics vlans
-------------------------------------------------------------------------------
14/1 nwEthernet1GbPort up/up Blaine's trunk -s---    1            9    none
                             Private
                             Net
1 record displayed
```

Example: Show an Ethernet Port's vNICs

In the following example, the `show ethernet-port vnics` command is issued against Ethernet port 1 on the card in slot 14.

```
show ethernet-port 14/1 vnics -detail
-------------------------------------------------------------------
name      havn71.Columbia
state     up/hostControlPathDown
mac-addr  00:13:97:01:F8:71
ipaddr    0.0.0.0/32
if        14/1
if-state  up
ha-state  standby
local-id  0
type      hostManaged
vlans     71
qos       --
flags     a-ct--B
-------------------------------------------------------------------
name      vn00.rock
state     up/up
mac-addr  00:13:97:01:F8:7E
ipaddr    0.0.0.0/32
if        14/1
if-state  up
```

```
ha-state
local-id  0
type      hostManaged
vlans     none
qos       --
flags     ---t---
-------------------------------------------------------------------
2 records displayed
```

Example: Watch an Ethernet Port

In the following example, the `watch` command is issued against Ethernet port 1 on the module in slot 14.

```
watch ethernet-port 14/1
Ethernet Ports measured in bytes       Wed Jul 13
name type              state v-res in in-rate out out-rate in-stats out-stats
-------------------------------------------------------------------------------
14/1 nwEthernet1GbPort up      9      207.578G 0  240.592G 0/0/0/0    0/0/0
1 record displayed
   q: quit, r: refresh, b: bytes, p: pkts, %: percent, m: mbps, u: up, d:
```

Maximum Transmission Unit

The maximum transmission unit (MTU) is the largest physical packet size (in bytes) that a network can transmit. MTU values are only applicable to Ethernet ports, and the MTU of the I/O port must match the MTU of the neighboring switch.

Syntax

```
set ethernet-port <slot>/<port> -mtu=<value> [-flowcontrol {default|true|false}]
set ethernet-port <slot/port> {down|up}
show ethernet-port {*|<slot>/<port>}
show ethernet-port alarms [-detail]
show ethernet-port qos [-detail]
show ethernet-port stats
show ethernet-port vnics [-detail]
```

Parameter Description

Parameter	Description
`set ethernet-port <slot>/<port>`	Identifies the I/O module and port to be configured.
`-mtu`	Sets the maximum transmission unit. The default MTU value is 1500. Accepted values are between 1500 and 9194. You cannot set the MTU for a port if there are any vNICs are configured on that port.
`-flow-control`	Switches MAC flow control on or off for the port. You cannot change this setting if there are any vNICs configured on the port.
`show ethernet-port`	Displays information about the requested port configuration items: • alarms—Displays any alarms, such as the port having become unavailable. • qos—Displays the quality-of-service policy set on the port, if any. • stats—Displays traffic statistics including MAC counters for the port. • vnics—Displays information about the vNICs that terminate on the port.

▼ Set the MTU

1. Select the I/O port and set the new MTU value:

```
set ethernet-port 4/1 -mtu=9194
```

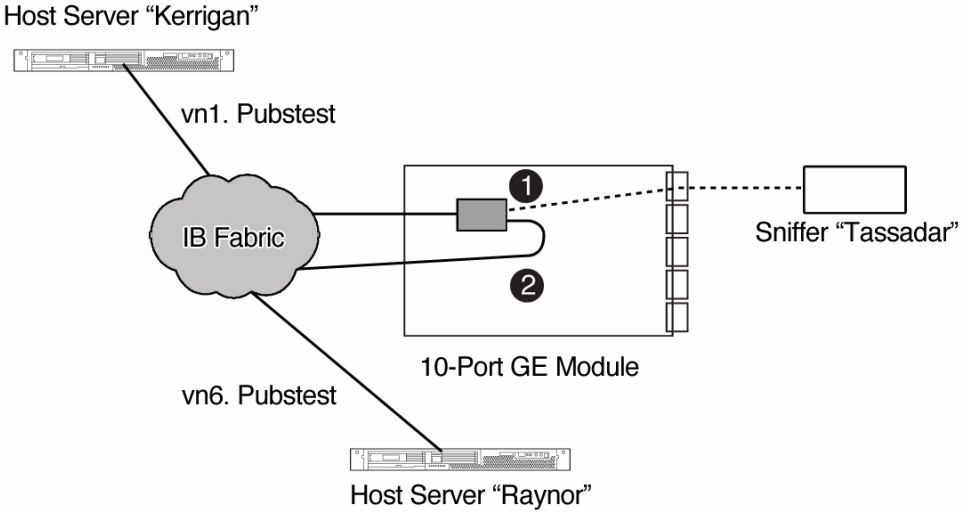
2. Confirm the new MTU setting:

```
show ethernet-port 4/1
------------------------------------------------------------------
name            4/1
type            nwEthernet1GbPort
state           up/up
descr
rate            auto/1Gbps
mtu             9194
avail-in-cir    0Kbps
avail-out-cir   1Gbps
mode            notApplicable
flags           -s-
lag
access-vlan     1
```

```
vnics           10
vlans           none
-------------------------------------------------------------------
```

vNIC Mirroring

The Oracle Fabric Interconnect supports vNIC Mirroring, which is a feature that enables duplicating data packets from one vNIC (the input) to a different output, either another vNIC (mirror to vNIC) or a physical Ethernet port (mirror to port). vNIC Mirroring is primarily used for troubleshooting, for example, to copy traffic off of one or more vNICs and send the traffic to a sniffer where traffic can be analyzed. Consider the example in the following figure..



The figure shows the two modes of vNIC Mirroring:

- When mirroring to a port (1, shown by a dashed line), the vNIC “vn1.pubstest” is terminated on the 10-Port GE module. This vNIC is the input vNIC. With a mirror-to-port configuration, all the packets between the original source and destination are forwarded as usual. However, an exact duplicate of the traffic flow on “vn1.pubstest” is copied and sent to an output port, on which a separate device (the sniffer “Tassadar”) is attached. Tassadar can then analyze all traffic on the port.
- When mirroring to a vNIC (2, shown by a solid blue line), the vNIC “vn1.pubstest” is terminated on the 10-Port GE module. This vNIC is the input vNIC. With a mirror-to-port configuration, all the packets between the original source and destination are forwarded as usual. However, an exact duplicate of the

traffic flow on “vn1.pubstest” is copied and sent to output vNIC “vn6.pubstest”, which is connected to another server. When traffic is carried on vn1.pubstest,” the server “Raynor” gets a copy of all packets.

Hardware Support

vNIC Mirroring is supported on all versions of GE module. vNIC Mirroring is supported for intra-module traffic, so traffic received on an I/O Module is copied to a destination on the same module only. You cannot configure vNIC Mirroring to span multiple I/O modules or Oracle Fabric Interconnects.

Mirror Traffic

The mirror traffic is left in its original state just as it appears on the wire:

- traffic is copied exactly from the input vNIC to the output vNIC or port.
- the Oracle Fabric Interconnect does not encrypt or decrypt data packets when copying them to the output mirror
- the Oracle Fabric Interconnect does not change or tag traffic in any way before or after it is sent to the mirror.
- if QoS causes packets to be dropped as they ingress or egress the I/O module, the same affect applies to the mirror. So, if traffic is dropped before transmission, those packets are not copied to the mirror.

Mirroring to vNIC

When you mirror to an output vNIC, the traffic is copied to another vNIC that is in either the same Server Profile or a different one. Typically, the output vNIC is hosted on a separate server that is dedicated to auditing and security, but this is not a requirement. One or more input vNICs can be mirrored to a single output vNIC.

The mirrored traffic is copied to the vNIC regardless of where the vNIC is terminated. When mirroring to a vNIC, the Oracle Fabric Interconnect places no restriction on the type of host where the output vNIC resides. So, for example, you could have the input vNIC on a Windows host, and the mirror vNIC could be hosted on a Linux host. The Oracle Fabric Interconnect would not prevent this configuration.

Mirroring to Port

When you mirror to an output port, the traffic is copied to another physical port that is on the same I/O Module. Typically, the output port is then connected to a physical device, like a sniffer. However, this is not a requirement.

The mirrored traffic is copied to the physical port regardless of whether the port has a physical connection or not. When mirroring to a physical port, there is no dependency on matching configurations between the Oracle Fabric Interconnect port and the peer device attached to the port.

Note – Mirroring between input I/O and an output I/O port is not supported because the input is always a vNIC. The option to mirror to a port only valid for an output.

Because multiple vNICs can be terminated on a port, the Oracle Fabric Interconnect supports mirroring all vNICs that are terminated on a port. By supporting this "mirror all vNICs" functionality, you do not need to individually configure multiple vNICs for mirroring. Instead, you can mirror all vNICs on a port by issuing one command on the port. Any vNICs terminated on that port are then mirrored.

Mirroring Considerations

Note – Because mirrors create a duplicate traffic stream, it is possible to inadvertently cause loops in the network if the mirrors are not created carefully.

Be aware of the following considerations when creating mirrors:

- Because incorrectly configured mirrors can cause network loops, if you have any uncertainty about whether your mirrors will cause loops, Oracle recommends that you contact Oracle Customer Support and request assistance. For information, see "Support and Accessibility" on page xxvi.
- As a general rule, only mirror to a port that is connected to a network analyzer.
- Do not mirror to a vNIC that is not terminated. If the mirror vNIC is not terminated, the Oracle Fabric Interconnect displays a "resource mismatch" error message. If you do not terminate the vNIC, the traffic will be copied, but will not be sent on the vNIC.
- When mirroring to the same port (for example, on the 10GE module which has only one port), you should use the optional `-mirror-mac=<mac-address>` argument to target a specific hardware address as the destination for the mirrored packets.

- When mirroring to a port connected to a network switch, you should use the optional `-mirror-mac=<mac-address>` argument to target a specific hardware address as the destination for the mirrored packets.
- When mirroring to a vNIC, Oracle suggests that you use the `-mac-address` option to specify a target device for the mirrored traffic.
- Mirroring adds overhead due to duplicating packets on the mirror. You can expect a negative affect on I/O module performance when mirroring is enabled. The severity of the negative performance varies due to multiple factors including (but not limited to) the number of packets being copied, the number of vNICs being mirrored, and whether mirroring is occurring on unidirectional or bidirectional traffic.

Syntax

vNIC mirroring for individual vNICs is configured through the `set vnic` command:

```
set vnic <vnic> -mirror=<vnic>|<ioport>
set vnic <vnic> -mirror-mac=<mac-address>
set vnic <vnic> -mirror-direction=<both|none|rxOnly|txOnly>
```

However, if you are using the option for mirroring all vNICs on a specific port, the following commands are required:

```
set ethernet-port <slot/port> -mirror-all-vnics=<vnic>|<ioport>
set ethernet-port <slot/port> -mirror-direction=<both|none|rxOnly|txOnly>
set ethernet-port <slot/port> -mirror-mac=<mac-address>
```

Parameter Description

Parameter	Description
`set vnic <vnic>`	Specifies the vNIC in the format “name.server-profile-name”. For example vn1.pubstest for the vNIC named vn1 that was created in server profile “pubstest”
`-mirror=<vnic|ioport>`	Specifies the output destination for the mirror, either a vNIC or a physical Gigabit Ethernet port.
`-mirror-mac=<mac address>`	For vNICs that are mirrored to a port, this qualifier specifies the destination hardware address of the device that will receive the mirrored traffic. By default, no MAC address is used.

Parameter	Description
-mirror-direction= <both|none|rxOnly|txOnly>	Provides control over which direction of traffic will be mirrored. By default, mirroring is disabled (none). Specifying none on a configured vNIC disables vNIC Mirroring but leaves the feature configured.
set ethernet-port <slot/port>	Identifies the I/O module and port on which all vNICs will be mirrored.
-mirror-all-vnics=<vnic|ioport>	Specifies the output destination for the mirrored vNICs. You can remove a configured mirror for all vNICs by specifying -mirror-all-vnics=none.
-mirror-direction= <both|none|rxOnly|txOnly>	Provides control over which direction of traffic will be mirrored. By default, mirroring is disabled (none). Specifying none on a configured mirror disables vNIC Mirroring but leaves the feature configured.
-mirror-mac=<mac-address>	For vNICs that are mirrored to a port, this qualifier specifies the destination hardware address of the device that will receive the mirrored traffic. By default, no MAC address is used.

Note – For the 10GE I/O module, use the <mac address> option because the module has only one port.

▼ Configure vNIC Mirroring for a Port

To configure an individual vNIC mirror on a port, use the set vnic commands. In this example, assume the input vNIC "vn1.pubstest" will be mirroring to slot 4, port 7. Only received packets will be mirrored.

1. Set the input vNIC to mirror to an output port:

```
set vnic vn1.pubstest -mirror=4/7
```

2. Set the direction of traffic that will be mirrored:

```
set vnic vn1.pubstest -mirror-direction=rxOnly
```

3. **Display detailed vNIC information to verify that the mirror was created. Look for the `mirror` field at the bottom of the display.**

```
show vnic vn1.pubstest -detail
------------------------------------------------------------------
name             vn1.pubstest
state            up/up
mac-addr         00:13:97:01:80:19
admin-ipaddr     0.0.0.0/32
oper-ipaddr      0.0.0.0/32
descr
if               4/1
if-state         up
mcast-group
type             dhcp
mtu              1500
group
group-pref
ha-state
flags            ---
vlans            none
access-vlan      1
mode             access
queue-map-type   disabled
qos              i-
local-id         0
mirror           4/7(rxOnly)
------------------------------------------------------------------
1 record displayed
```

As an option, you can also display the following commands to determine that mirror ports and mirror vNICs are configured and passing traffic:

```
watch ioports
watch vnics
```

If the counters are incrementing on the mirror port or vNIC(s), then the mirror is configured and supporting traffic.

▼ Configure vNIC Mirroring for a vNIC

To configure an individual vNIC mirror on a port, use the `set vnic` commands. In this example, assume the input vNIC “vn1.pubstest” will be mirrored to a vNIC named “vn6.pubstest”. Both received and transmitted traffic will be mirrored to this vNIC.

1. **Set the input vNIC to mirror to an output vNIC:**

```
set vnic vn1.pubstest -mirror=vn6.pubstest
```

2. **Set the direction of traffic that will be mirrored:**

```
set vnic vn1.pubstest -mirror-direction=both
```

3. **Display detailed vNIC information to verify that the mirror was created.**
   Look for the mirror field at the bottom of the display.

```
show vnic vn1.pubstest -detail
-------------------------------------------------------------------
name             vn1.pubstest1
state            up/up
mac-addr         00:13:97:01:80:19
admin-ipaddr     0.0.0.0/32
oper-ipaddr      0.0.0.0/32
descr
if               4/1
if-state         up
mcast-group
type             dhcp
mtu              1500
group
group-pref
ha-state
flags            ---
vlans            none
access-vlan      1
mode             access
queue-map-type   disabled
qos              i-
local-id         0
mirror           vn6.pubstest(both)
-------------------------------------------------------------------
1 record displayed
```

As an option, you can also display the following commands to determine that mirror ports and mirror vNICs are configured and passing traffic:

```
watch ioports
watch vnics
```

If the counters are incrementing on the mirror port or vNIC(s), then the mirror is configured and supporting traffic.

▼ Configure Mirror for All vNICs

To mirror all vNICs on a specific port, use the `set ethernet-port` commands. In the following example, assume all vNICs terminated on slot 4, port 1 will be mirrored to slot 4, port 5. Also assume that only transmitted packets will be mirrored.

1. **On the Ethernet Port, set all vNICs to be mirrored to a different port on the same I/O Module. For example:**

```
set ethernet-port 4/1 -mirror-all-vnics=4/5
This will set the mirror for all vNICs attached to port 4/1. Be
aware that this may affect performance and may cause network
disruption if loops are created in the external network.
network disruption if loops are created in the external network.
Are you sure you want to mirror all vNICs on this port (y/n)?y
```

2. **On the Ethernet port, set the direction for traffic that will be mirrored. For example:**

```
set ethernet-port 4/1 -mirror-direction=txOnly
```

3. **Display detailed vNIC information for all vNICs on the interface to verify that the mirror was created.**

   Look for the `mirror` field at the bottom of the display. For example:

```
show vnic * -detail where if=4/1
```

   This command displays a list of all the vNICs on the interface configured on slot 4, port 1. The output is displayed in a list that you can scroll through.

   As an option, you can also display the following commands to determine that mirror ports and mirror vNICs are configured and passing traffic:

```
watch ioports
watch vnics
```

   If the counters are incrementing on the mirror port or vNIC(s), then the mirror is configured and supporting traffic.

4. **If you need to undo the mirror-all-vNICs option, you use the** `-mirror-all-vnics` **qualifier and specify** `none` **(or leave it blank).**

   For example, to remove all mirror vNICs from slot 4, port 5:

```
set ethernet-port 4/5 -mirror-all-vnics=none
This will remove the mirror setting for all vNICs attached to port
4/5.
Are you sure (y/n)?y
```

▼ Disable and Enable vNIC Mirrors

You can disable and re-enable vNIC mirrors through the `-mirror-direction` qualifier, which defaults to `none`. To disable vNIC mirrors:

1. **Set the vNIC mirror direction to none. For example:**

```
set vnic vn1.pubstest -mirror-direction=none
```

2. **Verify that the vNIC mirror is no longer enabled (**`none`**) as documented in** "Display vNIC Mirrors" on page 104**.**

1. **To re-enable the vNIC mirror, set the mirror direction to a direction other than** `none`**.**

   For example, to re-enable the mirror for receive traffic only:

```
set vnic vn1.pubstest -mirror-direction=none
```

2. **Verify that the vNIC mirror is re-enabled as documented in** "Display vNIC Mirrors" on page 104**.**

Display vNIC Mirrors

vNIC Mirrors are displayed only through detailed vNIC information, which is available by using the `-detail` qualifier for the `show vnic` command. Detailed vNIC information contains the `mirror` field, which displays the mirror configuration for the input vNIC.

```
show vnic vn1.pubstest -detail
----------------------------------------------------------------
name            vn1.pubstest
state           up/up
mac-addr        00:13:97:01:80:19
admin-ipaddr    0.0.0.0/32
```

```
oper-ipaddr     0.0.0.0/32
descr
if              4/1
if-state        up
mcast-group
type            dhcp
mtu             1500
group
group-pref
ha-state
flags           ---
vlans           none
access-vlan     1
mode            access
queue-map-type  disabled
qos             i-
local-id        0
mirror          4/7(rxOnly)
------------------------------------------------------------------
1 record displayed
```

If the `mirror` field is empty, the vNIC is not configured as a mirror. For example:

```
show vnic vn4.pubstest -detail
------------------------------------------------------------------
name            vn4.pubstest
state           up/up
mac-addr        00:13:97:01:80:19
admin-ipaddr    0.0.0.0/32
oper-ipaddr     0.0.0.0/32
descr
if              4/1
if-state        up
mcast-group
type            dhcp
mtu             1500
group
group-pref
ha-state
flags           ---
vlans           none
access-vlan     1
mode            access
queue-map-type  disabled
qos             i-
local-id        0
```

```
mirror
------------------------------------------------------------------
1 record displayed
```

If the `mirror` field displays the output port or vNIC but also shows (`none`), the vNIC is currently disabled.

```
show vnic vn1.pubstest -detail
------------------------------------------------------------------
name            vn1.pubstest
state           up/up
mac-addr        00:13:97:01:80:19
admin-ipaddr    0.0.0.0/32
oper-ipaddr     0.0.0.0/32
descr
if              4/1
if-state        up
mcast-group
type            dhcp
mtu             1500
group
group-pref
ha-state
flags           ---
vlans           none
access-vlan     1
mode            access
queue-map-type  disabled
qos             i-
local-id        0
mirror          4/7(none)
------------------------------------------------------------------
1 record displayed
```

Controlling IGMP Delayed Leaves

With the IGMP delayed leave feature, the membership of a vNIC leaving an IGMP multicast group is terminated after a delay of 120 seconds instead of immediately. When IGMP delayed leave is active, the vNIC that sent the IGMP leave message continues to receive traffic on that IGMP Multicast group until the 120-second delay expires. At that point, the vNIC is aged out of the multicast table. Currently, the 120-second delay is not configurable, but in a future release, the delay will be configurable.

A common use case for delayed leaves is an ESX environment where a single vNIC may be acting as the uplink for many guests. Typically, in this scenario, multiple guests are hosting the same application which joins a given group. With the delayed leave feature, a guest terminating its membership in a group does not interrupt traffic for other guests receiving multicast traffic on the same group.

You can control delayed leaves on a per-I/O module basis through the `set ethernet-card` command. This command enables you to set the card to use either fast leaves or delayed leaves.

```
set ethernet-card <slot> -igmp-fastleave=<true|false|default>
```

Delayed leave is the default behavior.

Related Commands

Additional commands are available for displaying various aspects of the IGMP functionality.

Parameter	Description
`show ethernet-card <name>`	Displays the current setting for delayed IGMP fast joins and leaves through a flag in the command's output. For example: In the `enables` field, the dash (-) (shown in red text) indicates that IGMP delayed leave is enabled (the default) on the I/O Module.
`show vnic <vnic-name> igmp-stats`	Displays vNIC membership information and statistics for an IGMP Multicast group. No specific statistics are tracked for delayed leaves versus fast leaves. All leaves are tracked through the IGMP Leaves counter in this command's output.

Note – If the delayed leave features is not enabled and fast leaves are enabled instead, the `enables` field shows a `v` instead of a dash.

```
show ethernet-card 14
------------------------------------------------------------------
slot     14
state    up/up
descr
type     nwEthernet10Port1GbCard
vnics    20
qos      default
acl      FabricManagerGeneratedAclSet
```

```
enables  qas-
------------------------------------------------------------------
1 record displayed
```

Setting Allowed VLANs Per vNIC

With the Allowed VLANs feature, you can specify a list of VLANs that are allowed to pass over any trunk vNICs. (Access mode vNICs cannot receive the Allowed VLANs setting.) With this feature, the Network Cloud has a set of ranges of VLAN IDs that are allowed, and only traffic that is in the specified VLAN range is allowed to pass over trunk vNICs connected to the Network Cloud. By default, this option is set to allow all VLANs (1-4095) on the Network Cloud. Allowed VLANs are configured per network, so the server will receive the associated VLAN traffic when one or more vNICs terminated in a Network Cloud are deployed to any number of servers.

Consider an environment where virtualized servers are hosting many VMs. Different VMs must use different VLANs all running across a shared pair of vNICs, so limiting the range of VLANs is important because you will want to allow each vNIC to pass traffic for only very specific VLAN(s). Limiting the VLANs for a specific vNIC prevents the owners of the VMs from changing their own VLAN to another VLAN that has not been “allowed” and, in turn, accessing other data. So, the primary use case is where you want a Xsigo vNIC deployed to a hypervisor as a Trunk Mode vNIC. Then, you would define which vLANs are “allowed” to pass across that vNIC, thus isolating the VLAN traffic for the appropriate VM(s) only.

The Allowed VLAN range configured for the vNIC follows the vNIC. If you move or re-terminate the vNIC on a different server, the VLAN range will remain configured for the vNIC as long as the vNIC is connected to the Network Cloud.

Use the `set vnic add allowed-vlan` command to control which VLANs are allowed to pass over vNICs.

Command Syntax

```
set vnic <vnic-name> remove allowed-vlans <VLAN-range>
set vnic <vnic-name> add allowed-vlans <VLAN-range>
show vnic <vnic-name> -detail
```

Parameter Description

Parameter	Description
<vnic-name>	Specifies the name of the vNIC to which you are adding a range of allowed VLANs.
<VLAN-range>	Specifies the range of allowed VLANs, which can be either a single VLAN, a comma-separated list of VLANs, or a hyphenated range of VLANs.
-detail	Specifies that additional, detailed output is displayed. To display the allowed VLAN range, you must use this option.

▼ Set VLANs on a vNIC

Each vNIC comes with the default VLAN range (1-4095) already configured. To set a specific VLAN range you must delete this default VLAN range, then add the specific range.

1. **Display the configured VLANs for the vNIC to which you want to add an allowed VLAN range. You must use the `-detail` option to display the VLAN range for the vNIC. For example:**

```
show vnic vnic1.pluto -detail
----------------------------------------------------------------------
name             vnic1.pluto
state            up/up
mac-addr         00:13:97:03:71:5C
admin-ipaddr     0.0.0.0/32
oper-ipaddr      11.11.11.2/8
descr
if               7/10
if-state         up
mcast-group
type             hostManaged
mtu              9000
group
group-pref
ha-state
flags            -------
vlans            none
access-vlan      1
mode             access
queue-map-type   disabled
qos              --
local-id         0
mirror
```

```
community-name
allowed-vlans   1-4095
-----------------------------------------------------------------
1 record displayed
```

2. **Remove the existing VLAN configuration (if any) from the vNIC. For example:**

```
set vnic vnic1.pluto remove allowed-vlans *
```

3. **Add the specific range of allowed VLANs to the vNIC.**

   You can add the single VLAN, a comma-separated list of VLANs, or a hyphenated range of VLANs. For example:

```
set vnic vnic1.pluto add allowed-vlans 109-149
```

4. **Display the VLAN configuration for the vNIC to verify that the correct VLAN range is configured.**

   For example:

```
show vnic vnic1.pluto -detail
-----------------------------------------------------------------
name            vnic1.pluto
state           up/up
mac-addr        00:13:97:03:71:5C
admin-ipaddr    0.0.0.0/32
oper-ipaddr     11.11.11.2/8
descr
if              7/10
if-state        up
mcast-group
type            hostManaged
mtu             9000
group
group-pref
ha-state
flags           -------
vlans           none
access-vlan     1
mode            access
queue-map-type  disabled
qos             --
local-id        0
mirror
community-name
allowed-vlans   109-149
-----------------------------------------------------------------
1 record displayed
```

TCP Segmentation Offload

Virtual NICs support *TSO*, which allows large chunks of TCP data coming from a host server to be divided into a smaller TCP segments. When the host server sends one or more large chunks of data, they travel on the vNIC. On the 10 GE or 10-Port GE module where the vNIC is terminated, the large chunks of data are divided into smaller ones with a size determined by the maximum segmentation size (MSS). Then, these smaller MSS-size packets are sent onto the network. TCP segmentation offload (TSO) increases the outbound throughput and relieves CPU utilization on the host by performing TCP-packet processing functions on the I/O module instead of on the host.

Note – Another feature called Receive Batching performs the opposite function (coalescing numerous smaller packets) for traffic that the host server receives. Both TSO and Receive Batching can be configured on the same vNIC if your host(s) need performance optimization for both directions of traffic. For information, see "Receive Batching" on page 114.

Requirements

TSO support has the following requirements:

- For HA vNICs, both the primary and secondary vNIC must have the same TSO configuration.
- The following table shows the minimum versions that support TSO.

OS/Hypervisor Type	Version
XgOS	XgOS version 3.6.0 and later
Red Hat Linux 5 GA and later	Host driver version 5.x and later
ESXi 5.0 and later	Host driver version 5.3.0 and later
Windows	None currently, but TSO on Windows hosts will be supported in a future release of host drivers.

- This feature is supported only on Oracle Fabric Interconnect Gigabit Ethernet I/O cards that are listed as card type `EthIB` when you list the modules. All new Gigabit Ethernet I/O cards shipped from the factory will be `EthIB`, but some existing customers might have older cards that are not `EthIB`, and therefore will

not support TSO. If you have any question about the ability of a Gigabit Ethernet card to support TSO, issue the `show iocard` command. If the I/O card has the `EthIB` suffix, as shown, then that module supports TSO.

```
show iocard
slot state               descr type                      v-resources
-------------------------------------------------------------------
5    up/up                          nwEthernet1Port10GbCardEthIB  17
9    up/up                           sanFc2Port8GbLrCard          42
14   up/up                          nwEthernet10Port1GbCardEthIb  42
3 records displayed
```

Syntax

```
add vnic <name> <slot/port> -tso={default|true|false}
show vnic <name>|* [-detail]
```

Parameter Description

The TCP segmentation offload feature takes the following options:

Parameter	Description
`<name>|*`	Specifies the name of a vNIC on which the TSO will be configured, or all vNICs if you are using the wildcard.
`<slot/port>`	Specifies the slot and port termination for a vNIC that will support TSO.
`-tso={default|true|false}`	Specifies a choice list for enabling (true) or disabling (false) the feature, or restoring it to its default value (default). By default, TSO is disabled.
`-detail`	Is an optional argument that causes additional detailed output.

▼ Configure TCP Segmentation Offload

TCP segmentation offload is configured at vNIC creation through the `-tso` option for the `add vnic` command. When you configure TSO, checksumming is automatically enabled by default for the vNIC. You must leave checksumming

enabled for TSO to function. Because TSO is configured at vNIC creation time, you cannot disable this feature through runtime on the Oracle Fabric Interconnect. If you want to disable TSO, you must delete the vNIC and recreate it without the `-tso` flag.

1. **On a Oracle Fabric Interconnect, if a Server Profile does not already exist for the vNIC, create one now.**

2. **Add the vNIC with TSO enabled. For example:**

```
add vnic pubstest.foo 14/4 -tso=true
```

   When TSO is enabled, large chunks of TCP data that the host transmits over a vNIC will be segmented on the I/O module before being transmitted to the network.

3. **Check the detailed vNIC configuration to verify that TSO is configured.**

   For example:

```
show vnic pubstest.foo -detail
------------------------------------------------------------------
name            pubstest.foo
state           up/resourceUnavailable
mac-addr        00:13:97:0F:20:90
admin-ipaddr
oper-ipaddr
descr
if              14/4
if-state        down
mcast-group
type
mtu             1500
group
group-pref
ha-state
flags           --ct---
vlans           none
access-vlan     1
mode            access
queue-map-type  disabled
qos             --
local-id        0
mirror
community-name
allowed-vlans   1-4095
------------------------------------------------------------------
1 record displayed
```

4. **Check the `flags` field for `ct` where:**

   `t` indicates that TSO is configured on the vNIC.

   `c` indicates that checksumming is enabled on the TSO vNIC.

Receive Batching

Virtual NICs support Receive Batching (also called receive packet coalescing). This feature allows numerous small packets coming from the network to be bundled together into fewer and larger frames as they travel over the vNIC. On the 10 GE or 10-Port GE module where the vNIC is terminated, the smaller frames are merged together and sent to the host server. By reducing the amount of packets that are received, the host has fewer CPUs operations to perform in order to process the packets. Receive Batching increases the network throughput and lessens host CPU utilization by reducing the number of packets that the host receives. Receive Batching is considered from the perspective of the host server, so it applies to traffic that the server is receiving.

Note – Another feature called TCP segmentation offload performs the opposite function (segmenting large packets) for traffic that the host server is transmitting. Both Receive Batching and TCP segmentation offload can be configured on the same vNIC if your host(s) need performance optimization for both directions of traffic. For information, see "TCP Segmentation Offload" on page 111.

Receive batching for Linux hosts is supported for packets with an MTU less than or equal to 8192. The Linux host drivers automatically make this delineation, so if a host is receiving traffic with an MTU greater than 8192, the receive batching feature is off.

Requirements

- The following minimum versions of XgOS and host drivers are required to support Receive Batching:
  - XgOS 3.6.0 or later
  - OVN host driver version 4.2.0 or later
- For HA vNICs, both the primary and secondary vNIC must be configured with the same Receive Batching configuration.

Syntax

```
add vnic <name> <slot/port> -batching=[{default|true|false}]
show vnic <name>|* [-detail]
```

Parameter Description

The Receive Batching feature takes the following options:

Parameter	Description
<name>|*	Specifies the name of a vNIC on which Receive Batching will be configured, or all vNICs if you are using the wildcard.
<slot/port>	Specifies the slot and port termination for the vNIC that will support Receive Batching.
-batching={default|true|false}	Specifies a choice list for enabling (true) or disabling (false) the feature, or restoring it to its default value (default). By default, Receive Batching is disabled.
-detail	Is an optional argument that causes additional detailed output.

▼ Configure Receive Batching

Receive Batching is configured at vNIC creation through the `-batching` option for the `add vnic` command. You cannot disable this feature through runtime on the Oracle Fabric Interconnect. If want to disable Receive Batching for a vNIC, you must delete the vNIC and recreate it without the `-batching` flag.

1. **On the Oracle Fabric Interconnect, if a Server Profile does not already exist for the vNIC, create one now.**
2. **Add the vNIC with Receive Batching enabled.**

   For example:

```
add vnic pubstest.foo 14/4 -batching=true
```

   When Receive Batching is enabled, traffic that the host server receives on a vNIC will be batched on the I/O module before being sent to the server.

3. **Check the detailed vNIC configuration to verify that Receive Batching is configured.**

   For example:

```
show vnic pubstest.foo -detail
------------------------------------------------------------------
name            pubstest.foo
state           up/resourceUnavailable
mac-addr        00:13:97:0F:20:90
admin-ipaddr
oper-ipaddr
descr
if              14/4
if-state        down
mcast-group
type
mtu             1500
group
group-pref
ha-state
flags           ------B
vlans           none
access-vlan     1
mode            access
queue-map-type  disabled
qos             --
local-id        0
mirror
community-name
allowed-vlans   1-4095
------------------------------------------------------------------
1 record displayed
```

4. **Check the `flags` field for `B`, which indicates that Receive Batching is enabled for the vNIC.**

CHAPTER 7

Virtual LANs (VLANs)

A Virtual LAN (VLAN) is a private, independent, logical network that is created within a physical network. A VLAN behaves like an ordinary LAN, but connected devices do not have to be physically connected to the same network segment.

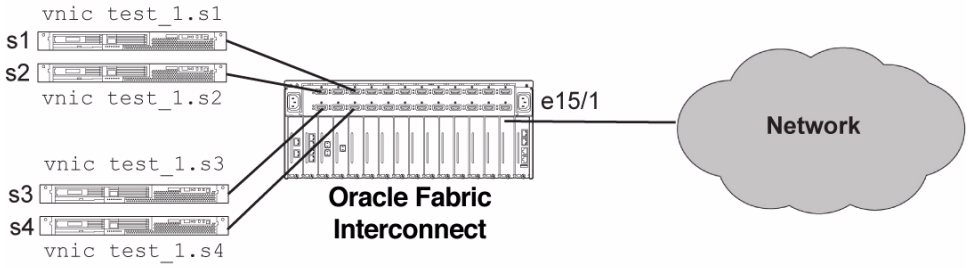
This chapter explains how to configure the Oracle Fabric Interconnect for host-managed and chassis-managed VLANs. It contains the following sections:

- "Operations" on page 117
- "Configuration Overview and Guidelines" on page 118
- "Properties" on page 120
- "Configuration Options" on page 123
- "Configuring VLANs" on page 125

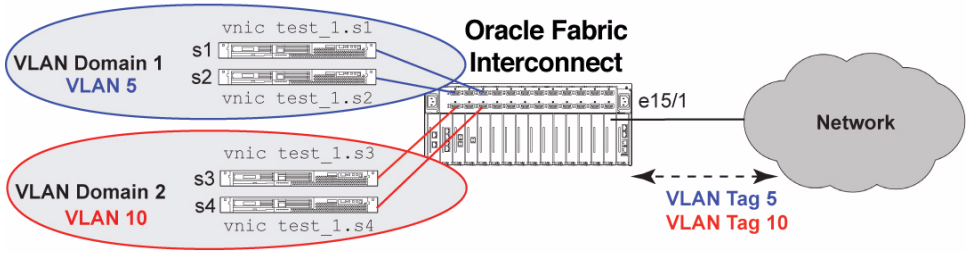
VLANs, like most objects in the Oracle Fabric Interconnect, have "Naming Conventions" on page 8.

Operations

VLANs enable you to create isolation and security in the network by creating a smaller, more focused virtual LAN within the overall network. Consider the example in the following figure.



In this example, only the default VLAN (VLAN 1) is present. As a result, no isolation exists, and all hosts (s1, s2, s3, and s4) can see each other on the network. This scenario might not be preferable in situations where you want some hosts to be isolated from others. You can use VLANs to accomplish the isolation. Consider the example in the following figure.



In this figure, VLANs are configured. Packets that are tagged with unique VLAN IDs are transmitted and received on specific vNICs to support communication between specified servers. For example, the packets that are supported on vNICs in VLAN 5 will be transmitted and received on interfaces that support VLAN 5. As a result, only hosts s1 and s2 know about each other, and traffic to and from those hosts is kept isolated from hosts s3 and s4 in VLAN 10. Servers s3 and s4 know only about each other and traffic for hosts s3 and s4 is also kept isolated from traffic related to VLAN 5.

Configuration Overview and Guidelines

Configuring VLANs requires setting VLAN properties on an Ethernet port and on any vNICs terminating on that port. The names and definitions of VLAN properties for an Ethernet port and a vNIC are identical, except for the `tag-native` property which is applicable to Ethernet ports only. For information about the `tag-native` property, see "Tag Native" on page 121.

These properties collectively define rules by which the Oracle Fabric Interconnect operates and handles VLAN tagged and untagged frames.

When configuring a VLAN, you must set VLAN properties on the Ethernet port before any vNICs are assigned to it.

If you are changing the VLAN settings of an Ethernet port that already has configured vNICs bound to it, you must remove all the vNICs associated with the terminating port before changing the settings. Otherwise, `set` commands fail. VLAN properties are configured on an Ethernet port using the `set ethernet-port` command. For additional information about the VLAN properties of an Ethernet port, see "Ethernet Port" on page 120.

Be aware that the configuration of VLAN properties must match on both ends of the physical connection. Any mismatch in configuration results in improper handling of data traffic.

After the VLAN properties of the Ethernet port are configured, vNICs can be created and terminated on the port with appropriate VLAN properties.

A vNIC's VLAN properties are configured depending on the type of configuration method chosen, either host managed or chassis managed.

Note – A VLAN can be configured for a Link Aggregation Group (LAG) as well as an Ethernet port. Any VLAN properties configured to the LAG are set on all Ethernet ports in the LAG group, the same as a single Ethernet port in a VLAN. There are no special commands or configuration steps for configuring VLANs on a LAG.

Host-Managed VLANs

Host-managed VLANs are configured and managed from the host server using the native operating system tools. This method can help administrators by allowing them to use traditional administrative tools and methods to configure the vNIC accordingly. For more information about configuring host-managed VLANs, see "Host-Managed VLAN Configuration" on page 124.

Chassis-Managed VLANs

Chassis-managed VLANs are configured and managed from the XgOS CLI. For more information about configuring chassis-managed VLANs, see "Chassis-Managed VLAN Configuration" on page 124.

Properties

VLANs are configured through various VLAN properties on Ethernet ports and vNICs.

Ethernet Port

The port properties documented in this section are supported on all versions of GE I/O modules.

Mode

This property specifies how VLAN tagged and untagged frames must be handled across the port. It also indicates whether the port can be configured to carry multiple VLAN traffic or just allow untagged frames in its access VLAN domain only.

You can set the Ethernet port's VLAN mode through the `set ethernet-port` command, as shown:

```
set ethernet-port <slot/port> -mode=access|trunk
```

The `-mode` option takes the following qualifiers:

`access`	By default, an Ethernet port operates in access mode, meaning it forwards (transmits or receives) untagged frames only. All tagged frames received from the network or vNIC are dropped. Use trunk mode, when both untagged and VLAN tagged frames are to be carried across the Ethernet port.
	You can set access mode of operation through the commands, as shown:
	`set ethernet-port <slot/port> -mode=access`
	`set lag <slot.id> -mode=access`

trunk	In this mode, by default, the port allows transmission and reception of both tagged and untagged frames. Any untagged frames arriving from the network are forwarded to the port's access VLAN domain. For information about access VLAN property of the port, see "Access" on page 121.
	Furthermore, optionally, untagged frames can be forwarded with a default VLAN tag inserted as specified by the `tag-native` property. For more information about this property, see "Tag Native" on page 121.
	You can set trunk mode of operation through the `set ethernet-port` command, as shown:
	`set ethernet-port <slot/port> -mode=trunk`
	`set lag <slot.id> -mode=trunk`

Access

This property specifies the default VLAN domain with which the port is associated. The default access VLAN is 1. You can change the access VLAN ID of a port, but only if no vNICs are assigned to the port. You can change the access VLAN ID of a port by using the `set ethernet-port` command as shown:

```
set ethernet-port <slot/port> -access-vlan=<id>
set lag <slot.id> -access-vlan=<id>
```

Typically, frames in this VLAN domain are untagged and forwarded "as is."

Note – OVN uses the term "access VLAN ID" to specify the untagged traffic domain. While it is standard to use this term when operating in access mode, it is common to see the term "native VLAN ID" being used when the port is configured as a trunk port. OVN uses the term "access VLAN ID" consistently for both modes of operation. Be aware that the property "access VLAN" can be refer to both the "access VLAN ID" or "native VLAN ID" of the port interchangeably depending on its mode of operation.

Tag Native

By default, untagged frames in the access VLAN domain are forwarded "as is" across a trunk port. In this default behavior, the value of `tag-native` property is "false". Based on the configuration requirements, you might prefer that only tagged frames are forwarded across the port. In this case, the `tag-native` property must be set to "true," which results in a default VLAN tag being inserted to the frame before forwarding it across the port.

- When `tag-native=true`, in the egress path, VLAN ID of the newly inserted tag on an untagged frame equals the access VLAN ID of the vNIC transmitting the frame.
- When `tag-native=true`, in the ingress path, all untagged frames arriving from the network are dropped.

You can change the `tag-native` property to "true" through the `set ethernet-port` command, as shown:

```
set ethernet-port <slot/port> -mode=trunk -tag-native=true
set lag <slot.id> -mode=trunk -tag-native=true
```

Note – Port mode must be `trunk` when specifying the `-tag-native=true` option.

vNIC's VLAN Properties

The vNIC's VLAN properties documented in this section are supported on all versions of GE I/O Module.

After the Ethernet port's VLAN properties are configured, a vNIC can be created and terminated on it. When a vNIC is created, it is in access mode of operation by default and belongs to the same VLAN domain as its terminating port.

Before configuring VLAN properties of a vNIC, it is important to understand the administrative requirements of the vNIC in terms of its VLAN configuration. A vNIC's VLAN configuration can occur through either of the following methods:

- host-managed VLANs. See "Host-Managed VLANs" on page 119.
- Chassis-managed VLANs. See "Chassis-Managed VLANs" on page 119.

Depending on the configuration method chosen, the VLAN properties might be set differently. The VLAN properties that control configuration are `mode` and `access VLAN`.

Mode

This property specifies how VLAN tagged and untagged frames must be handled. It also indicates whether the vNIC can be configured to carry multiple VLAN traffic or just allow untagged frames in its access VLAN domain only.

You can set the vNIC mode for the VLAN at vNIC creation time, by using the `add vnic` command as shown:

```
add vnic <vnic-name>.<server-profile-name> <slot/port> -mode=access|trunk
```

The `-mode` option takes the following qualifiers:

`access`	By default, a vNIC operates in access mode, meaning it forwards (transmits or receives) only untagged frames in its access VLAN domain. All tagged frames received from the network and received on this vNIC are forwarded with the tag removed as long as the frame belongs in its access VLAN domain. Otherwise, the frame is not forwarded to this vNIC. The Oracle Fabric Interconnect drops any outgoing tagged frames on this vNIC. Use the trunk mode of operation when both untagged and VLAN tagged frames are to be forwarded to or from the vNIC. Access mode can be configured only at vNIC creation time, by using the add vnic command as shown: `add vnic <vnic-name>.<server-profile-name> <slot/port> -mode=access`
`trunk`	In this mode, the vNIC allows transmission and reception both tagged and untagged frames. The Oracle Fabric Interconnect passes all tagged and untagged traffic across this vNIC without modification. Trunk mode can be configured only at vNIC creation time, by using the `add vnic` command as shown: `add vnic <vnic-name>.<server-profile-name> <slot/port> -mode=trunk`

Access

This property specifies the default VLAN domain that the vNIC belongs to. By default, the access VLAN is inherited from the vNIC's terminating port.You can change a vNIC's access VLAN at vNIC creation time by using the `add vnic` command as shown.

```
add vnic <vnic-name>.<server-profile-name> <slot/port> -access-vlan=<id>
```

Configuration Options

A vNIC's VLAN configuration can occur through either of the following methods:

- host managed

- chassis managed

Host-Managed VLAN Configuration

With this method, the user only adds a vNIC to the server on the chassis and manages its VLAN configuration from the server using the native operating system tools. To support host-managed VLANs, the vNIC must be created in trunk mode. For information about trunk mode, see "Mode" on page 122.

This serves as an acknowledgement to the vNIC configuration software on the chassis that the VLANs are configured from the host side and the Oracle Fabric Interconnect should honor VLAN configuration requests coming from the host.

The Oracle Fabric Interconnect can thus allow tagged packets to go across this vNIC which otherwise would get dropped when the vNIC is in access mode of operation.

The Oracle Fabric Interconnect-maintained vNIC configuration information is updated as VLANs are configured on the host. This information can be displayed using the `show vlans` command.

All host-managed VLANs are shown as `hostManaged` in the `Type` column of the `show vlans` output.

```
show vlans
name              state   descr      admin-addr      oper-addr       type
------------------------------------------------------------------------------
100.vn1.fir       up                 0.0.0.0/32      40.40.40.11/24  hostManaged
100.vn1.xc15      up                 40.40.40.10/24  40.40.40.10/24  static
2 records displayed
```

The output of the `show vlans` command contains two address fields: `admin-addr` and `oper-addr`. The `admin-addr` field is the VLAN's IP address that is configured on the Oracle Fabric Interconnect, and the `oper-addr` field is the VLAN's IP address configured on the host. If a VLAN is host-managed, the `admin-addr` shows 0.0.0.0.

Chassis-Managed VLAN Configuration

VLANs are configured from the Oracle Fabric Interconnect through the `add vlan` and `set vlan` command sets. Currently only one chassis-managed VLAN can be configured per vNIC.

All chassis-managed VLANs are flagged as `static` in the `type` column of the `show vlans` command.

```
show vlans
name              state   descr      admin-addr      oper-addr       type
-------------------------------------------------------------------------------
100.vn1.fir       up                 0.0.0.0/32      40.40.40.11/24  hostManaged
100.vn1.xc15      up                 40.40.40.10/24  40.40.40.10/24  static
2 records displayed
```

The output of the `show vlans` command contains two address fields: `admin-addr` and `oper-addr`. The `admin-addr` field is the VLAN's IP address that is configured on the Oracle Fabric Interconnect and the `oper-addr` field is the VLAN's IP address configured on the host. If the VLAN is chassis-managed, the `admin-addr` and `oper-addr` field should be the same because the IP address information configured on the Oracle Fabric Interconnect should be the same as configured on the host. If the VLAN is chassis managed, and the two address fields are different, someone has changed the IP address information on the host itself. The different IP addresses indicates a configuration error.

By default a vNIC is created in access mode.

Note – Configuring a VLAN interface by using the `add vlan` command on this vNIC will automatically change the vNIC from access to trunk. You can check this change by issuing the `show vnic` command and checking its output.

Configuring VLANs

When configuring a VLAN, the primary questions you must answer are as follows:

- Whether the host server must be VLAN aware.
- Whether the Ethernet port will connect to a network that will carry multiple VLAN traffic.

The answer will affect what mode (trunk or access) you configure for vNICs and Ethernet ports that are members of the VLAN.

A successful VLAN configuration requires configuration of the following parameters:

1. Ethernet port parameters: Ethernet port parameters are set first.
2. vNIC parameters: vNIC parameters are set after the port parameters.

Before adding a VLAN, you will find it helpful to:

1. Determine if vNIC tags must be preserved between the Oracle Fabric Interconnect and a peer Ethernet device. If tags must be preserved, the port mode must be set to trunk mode. If not, the port mode must be set to access mode. It is mandatory for the Oracle Fabric Interconnect's port mode and the Ethernet switch's port mode to be set to the same operational mode (either trunk or access) to transmit or receive tagged or untagged packets between hosts.
2. Determine if the host will be VLAN aware. If so, the vNIC must be set to trunk mode. If not, then the vNIC will be set to access mode.
3. Create the vNIC(s) that will be members of the VLAN(s).

The following sections document syntax for commands related to configuring VLANs and provide some examples of common configurations as guidelines for your network.

Syntax

```
add server-profile <profile-name> <server>@<f1-15>:<ib-port>
add vnic <vnic-name>.<server-profile-name> <slot>/<port> -mode={access|trunk}
    -access-vlan={<number>|default |none}
add vlan <vlan-id>.<vnic>.<profile-name> [-noconfirm]
set ethernet-port <slot>/<port> -access-vlan={<number>|default}
    -mode{access|trunk} -tag-native={default|false|true}
set vlan <vlan-id>.<vnic>.<profile-name> -ip-addr=<addr/mask>] [-descr="<text>"]
    [-addr-type=[default|hostManaged|static|dhcp] [-netmask=<n.n.n.n>]
set vnic <vnic-name>.<server-profile-name> -addr-type=<type> -ip-addr=<addr>
    -netmask=<n.n.n.n>
show vlans [{*|<name>}]
show vnic <vnic-name>.<server-profile-name> vlans [-detail]
```

10GE and 10-Port GE VLAN Examples

The following sections show VLAN configuration examples for the 10GE and 10-Port GE module.

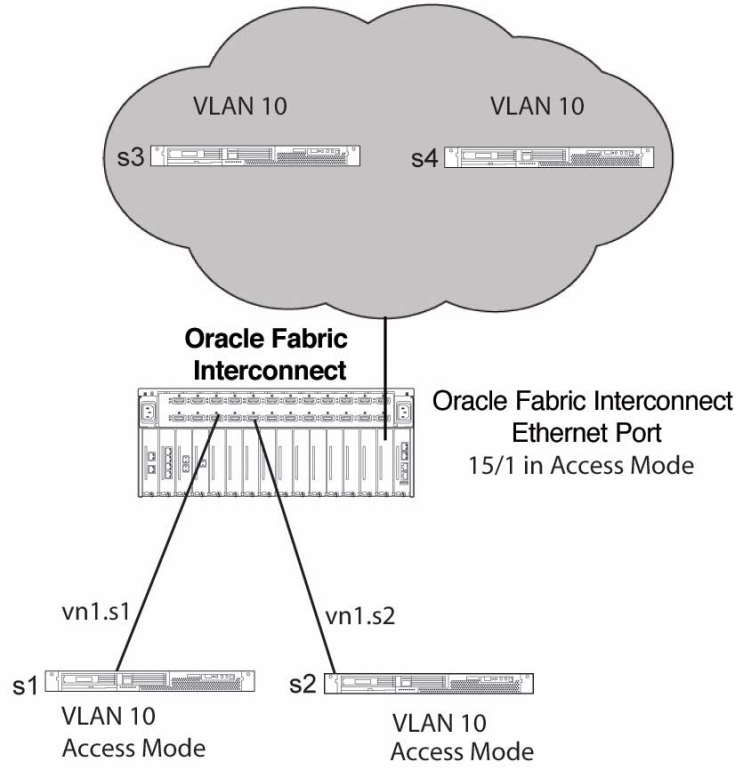
All of the following examples assume that a server profile has already been created.

- "Example 1: Port Access Mode, VLAN-Unaware Host" on page 127
- "Example 2: Port Trunk Mode, VLAN-Aware Host" on page 128

- "Example 3: Port Trunk Mode, VLAN-Unaware Host" on page 129
- "Example 4: Port Trunk Mode, VLAN-Unaware Host and HA vNICs" on page 130

Example 1: Port Access Mode, VLAN-Unaware Host

In this example, the hosts are not VLAN aware. As a result, they will not be isolated from other hosts. Consider the example in the following figure.



In this example, the hosts do not require unique VLANs. When traffic is sent to or from hosts, the traffic is part of the same VLAN. When the traffic is sent between the Oracle Fabric Interconnect and the external network, no tags are kept. All hosts and traffic are in a "flat" configuration where they belong to the same VLAN, so no isolation occurs.

The configuration procedure for this example would be as follows:

1. Configure the Ethernet port mode:

```
set ethernet-port 15/1 -mode=access -access-vlan=10
```

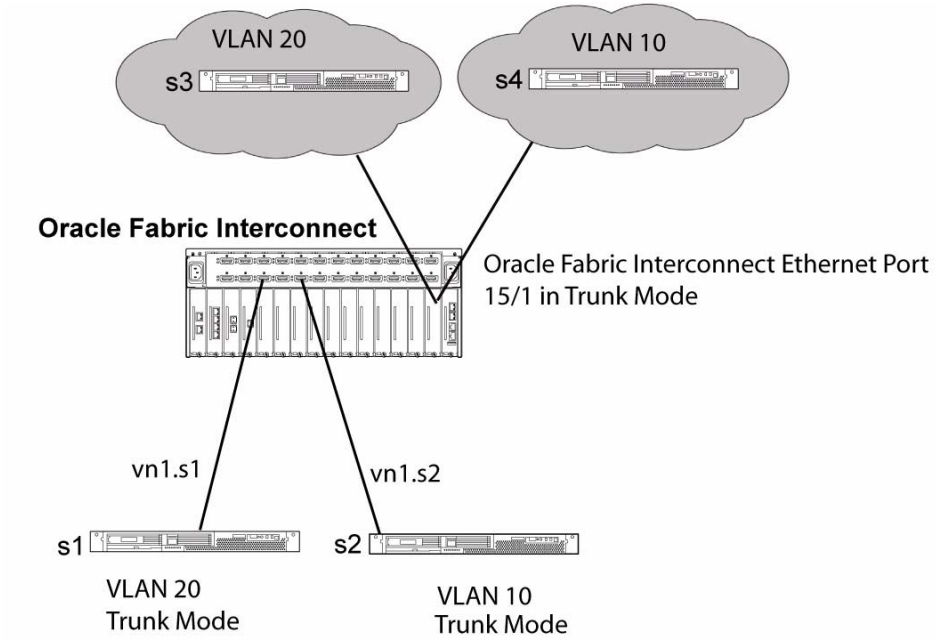
2. Add vNICs to the hosts:

```
add vnic vn1.s1 15/1 -mode=access -access-vlan=10
add vnic vn1.s2 15/1 -mode=access -access-vlan=10
```

3. On the hosts, configure the IP addresses.

Example 2: Port Trunk Mode, VLAN-Aware Host

In this example, the hosts are VLAN aware. As a result, they will be isolated from other hosts that are not part of the same VLAN. Consider the example in the following figure.



In this example, the hosts are aware of VLAN tags. Because the hosts are VLAN aware, the vNICs must be set to trunk mode so that VLAN tags are preserved. The Ethernet port mode is also set to trunk mode so that VLAN tags are preserved on the link between the Oracle Fabric Interconnect and the external network. The result is that hosts s1 and s3 can communicate with each other, and hosts s2 and s4 can communicate with each other. The VLAN boundaries are enforced, so hosts in each VLAN do not know about the others and traffic within each VLAN stays in the VLAN.

The configuration procedure for this example would be as follows:

1. Configure the Ethernet port mode:

```
set ethernet-port 15/1 -mode=trunk -access-vlan=1
```

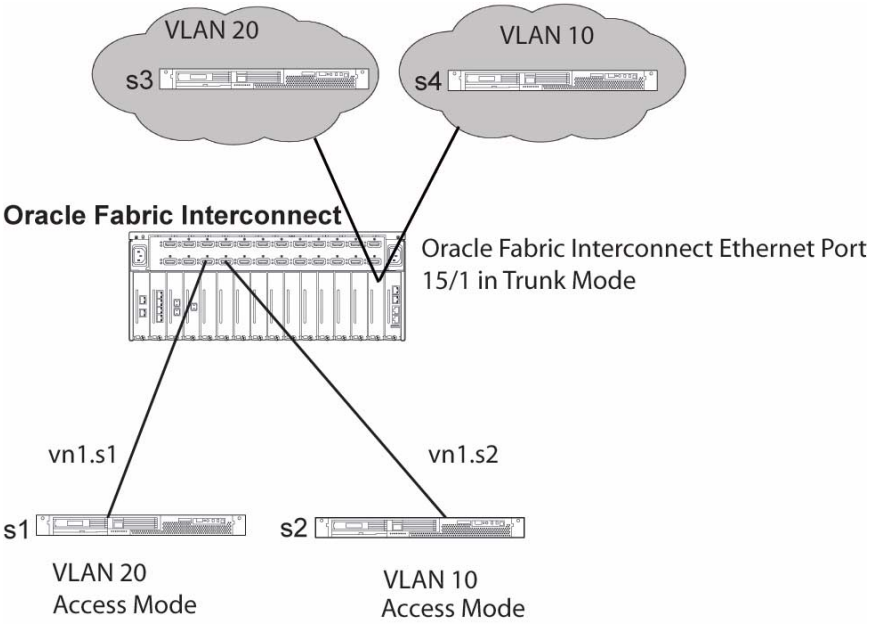
2. Add vNICs to the hosts:

```
add vnic vn1.s1 15/1 -mode=trunk -access-vlan=1
add vnic vn1.s2 15/1 -mode=trunk -access-vlan=1
```

3. On the hosts, configure the VLAN interfaces and assign an IP address to the VLAN.

Example 3: Port Trunk Mode, VLAN-Unaware Host

Consider the example in the following figure.



In this example, traffic to and from the hosts does not contain any VLAN tags. Because the port mode is trunk, VLAN tags are preserved between the Oracle Fabric Interconnect and the external network.

The configuration procedure for this example would be as follows:

1. Configure the Ethernet port mode:

```
set ethernet-port 15/1 -mode=trunk -access-vlan=1
```

2. Add vNICs to the hosts:

```
add vnic vn1.s1 15/1 -mode=access -access-vlan=20
add vnic vn1.s2 15/1 -mode=access -access-vlan=10
```

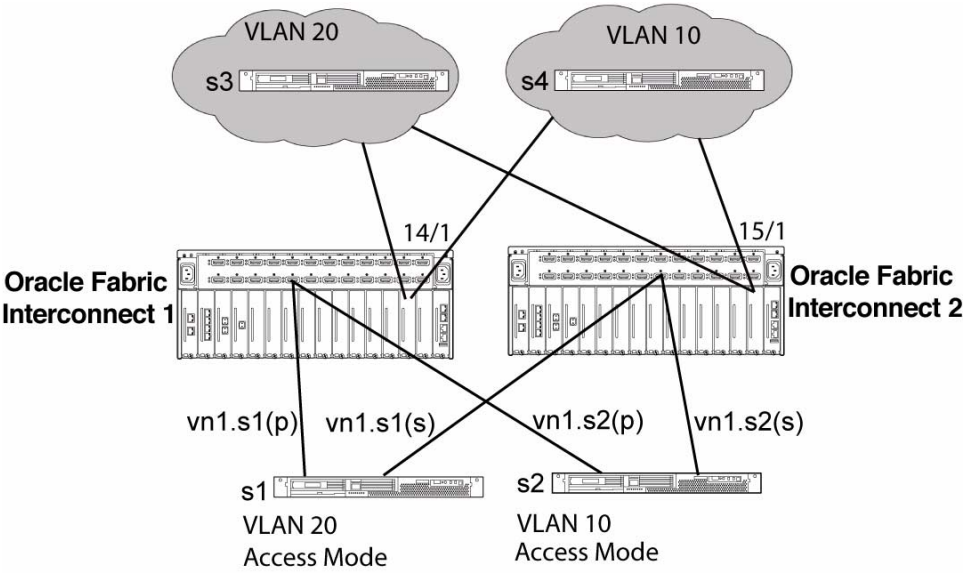
3. On the hosts, configure IP address information.

Example 4: Port Trunk Mode, VLAN-Unaware Host and HA vNICs

In this example, the following environment applies:

- HA vNIC pairs are configured on the Oracle Fabric Interconnects.
- The servers are using the Linux or Windows operating system.
- ESX Server uses its own NIC teaming to achieve an HA interconnect.
- The hosts are not VLAN aware.

Consider the example in the following figure.



In this example, s1 and s2 are not VLAN-aware. The Oracle Fabric Interconnect is responsible for inserting and removing VLAN tags to keep traffic isolated. Host servers s1 and s2 have redundant paths.

The configuration process for this example is as follows:

1. On Oracle Fabric Interconnect 1, configure the Ethernet port mode:

```
set ethernet-port 14/1 -mode=trunk -access-vlan=1
```

2. Add vNICs to the hosts:

```
add vnic vn1.s1 14/1 -mode=access -access-vlan=20 ha -primary
add vnic vn1.s2 14/1 -mode=access -access-vlan=10 ha -primary
```

3. On Oracle Fabric Interconnect 2, configure the Ethernet port mode:

```
set ethernet-port 15/1 -mode=trunk -access-vlan=1
```

4. Add vNICs to the hosts:

```
add vnic vn1.s1 15/1 -mode=access -access-vlan=20 ha -secondary
    -mac=<mac_from_vn.1.s1_on_I/O_Director_1>
add vnic vn1.s2 15/1 -mode=access -access-vlan=10 ha -secondary
    -mac=<mac_from_vn.1.s2_on_I/O_Director_1>
```

5. On the hosts, configure the IP addresses.

CHAPTER 8

Virtual Host Bus Adapters (vHBAs)

The Oracle virtual Host Bus Adapter (vHBA) virtualizes HBA connectivity. It appears to the OS as a physical HBA and enables a server to have a Fibre Channel (FC) SAN attachment without having a physical HBA present. Instead of the host server using an HBA, an InfiniBand (*IB*) HCA is used which then virtualizes the HBA allowing for SAN connectivity.

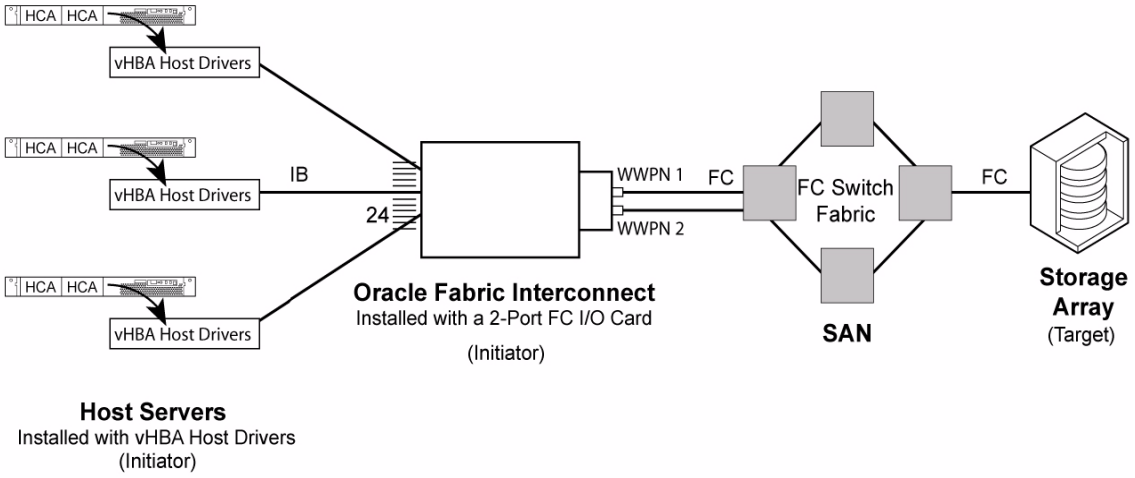
This chapter explains how to configure vHBAs in the following sections:

- "vHBA Topology" on page 134
- "Basic vHBA Configuration" on page 136
- "Persistent Binding" on page 142
- "Target Prescan and Rescan" on page 146
- "Set FC Card Attributes" on page 151
- "Set FC Port Attributes" on page 153
- "Removing vHBAs" on page 158
- "vHBA Statistics" on page 167
- "Fibre Channel Monitoring" on page 168
- "LUN Masking" on page 169
- "Optional LUN Masking: No Report LUN Interception" on page 174
- "Change Port Topology from Fabric to Loop" on page 176

Virtual HBAs, like most objects in the Oracle Fabric Interconnect, have "Naming Conventions" on page 8.

vHBA Topology

The following figure displays a typical vHBA topology.



An IB connection exists between the Oracle Fabric Interconnect and host servers supporting the OVN vHBA host software stack. Up to 24 IB ports are supported. A 2-port FC I/O card connects to a storage area network (SAN) FC switch fabric. All the host server vHBAs multiplex through the FC ports on the I/O card. A storage array is attached to the switch fabric. Initiators are host servers that request I/O processing and actively seek out and interact with target devices on the SAN. Targets are passive storage devices (arrays, *JBOD*s, *RAID*s, and so on) that respond to requests sent by initiators. The Oracle Fabric Interconnect itself is an I/O initiator that provides a conduit for host-server initiators to send commands to the fabric.

Note – Some target devices function also as data replicators. In this case, these targets function also as I/O initiators replicating data (sync) to other locations.

The vHBA host software defines how the FC protocol will be transported (in/out) over IB. Without this software and the details of the transport, the vHBA will not function and the payload cannot be sent over IB.

Both initiators and targets have a World Wide Node Name (WWNN) and a World Wide Port Name (WWPN). A 2-port FC card itself has one WWNN, and each port has its own WWPN. These IDs register with one another to establish communication.

N_Port ID Virtualization (NPIV) enables multiple fibre channel initiators (WWNs) to log in and occupy a single physical port. Your switch device (between the Oracle Fabric Interconnect and the storage device) must support NPIV and NPIV must be turned on. Some switches might require a software upgrade to support NPIV.

Without NPIV, a vHBA cannot log into the fabric. Note that some switches require configuring the max number of NPIV logins.

Note – Reset the Oracle Fabric Interconnect's FC I/O module whenever the firmware is changed on the upstream FC switch. The I/O module needs to rediscover the FC setting attributes. Do this by using the `set fc-card <slot> reset` command

---

See "SAN QoS for vHBAs" on page 209 for information about using vHBAs with QoS.

Determining the Number of LUNs Supported on a Single Host

As a general guideline, on each particular host server, the total number of supported LUNs should be less than or equal to 256. However, on some hosts, it might be possible to exceed the guideline of 256 LUNs per host by changing host hardware or software settings.

When you are configuring vHBAs on individual host servers, use the following formula to verify that your deployment is in compliance with the general guideline of less than or equal to 256 LUNs per host:

(Number of vHBAs) * (Number of Targets per vHBA) * (Number of LUNs per target) <= 256

where:

- Maximum number of vHBAs for a host is 16
- Maximum number of targets for an vHBA is 64
- Maximum number of LUNs per targets for a target is 256

Some examples of the formula and individual limits:

- (2 vHBAs) * (64 targets) * (2 LUNs) = 256, which complies with the rule of 256 total LUNs per host, and the maximum of 64 targets per vHBA
- (4 vHBAs) * (16 targets) * (4 LUNs) = 256, which complies with the rule of 256 total LUNs per host
- (16 vHBAs) * (4 targets) * (4 LUNs) = 256, which complies with the rule of 256 total LUNs per host, and the maximum of 16 vHBAs per host

- (4 vHBAs) * (4 targets) * (2 LUNs) = 32, which complies with the rule of 256 total LUNs per host. This example shows that less than 256 LUNs per host are supported.
- (1 vHBA) * (1 target) * (256 LUNs) = 256, which complies with the rule of 256 total LUNs per host, and the maximum of 256 LUNs per target

Basic vHBA Configuration

The following command syntax and example show basic vHBA configuration.

Syntax

```
add server-profile <profile-name> <server>@<f1-15>:ServerPort<ib-port-num>
add vhba <vhba-name>.<profile-name> <slot>/<port> [-local-id <ID>
    -lun-mask <mask> -map <map> -mtu <MTU-size> -no-lun-masking
    -wwn-id <WWN-suffix>]
show vhba <wildcard> <vhba-name>.<profile-name> -detail
remove vhba <wildcard> <vhba-name>.<profile-name> [-noconfirm]
```

Note – The process of removing a vHBA depends upon the environment in which it operates. For instructions about removing a vHBA, see"Removing vHBAs" on page 158.

Parameter Description

Parameter	Description
`add vhba <vhba-name>.<profile-name>`	The name of the vHBA you are creating. The `vhba-name` portion must be unique in the Oracle server profile to which it is assigned. The `profile-name` is the name of a server profile which you have already created.
`<slot/port>`	The I/O module and port number where this vHBA terminates.

Optional Modifiers

Modifier	Description
`-detail`	An optional modifier that allows displaying detailed information (if available) for the vHBA.
`-local-id`	The identifier used by ESX Server to map its HBA to this vHBA. Enter 1 to 32. Each ID must be unique per ESX Server.
`-lun-mask`	Sets LUN mask on targets visible to this vHBA. For more about LUN masking vHBAs, see "LUN Masking" on page 169.
`-map`	Sets persistent SAN map. For more about persistent mapping, see "Persistent Binding" on page 142.
`-mtu`	Sets maximum transmission unit. Acceptable values: • 2048: 2MB • 256: 256KB (this is the default value) • 512: 512KB • 1024: 1MB • default: 256KB
`-no-confirm`	Allows removing vHBAs without displaying a confirmation prompt. This option assumes "yes" to the prompt asking for confirmation, and if used, no warning messages will be displayed and the vHBA will be immediately delete.
`-no-lun-masking`	Sets no LUN reporting on this vHBA. For more information, see "Optional LUN Masking: No Report LUN Interception" on page 174.
`<wildcard>`	Allows specifying selected wildcard characters (for example, *) to facilitate executing a command for one or more vHBAs.
`-wwn-id`	Specifies a particular WWN. This option allows you to enter the WWN suffix, which is the last 12 bits of the WWN address. The WWN suffix is a 12-bit hexadecimal number from 100 to FFF.

▼ Configure a Basic vHBA

Take the following steps to enable a minimum vHBA configuration:

1. Create a named server profile and bind it to a physical-server connection:

```
add server-profile myserver ceasar@iowa:ServerPort24
```

2. **Find an FC card (`sanFc2Port4GbLrCard`) on which you can terminate a vHBA:**

```
show iocard
slot        state    descr    type                  v-resources
-------------------------------------------------------------------
1           up/up             sanFc2Port4GbLrCard    0
2           up/up             sanFc2Port4GbLrCard    0
3           up/up             sanFc2Port4GbLrCard    0
4           up/up             sanFc2Port4GbLrCard    0
4 records displayed
```

3. **Find an FC slot/port to which you will assign a vHBA.**

   In this example, 2/1 will be used:

```
show ioport
name        type              state         descr       v-resources
-------------------------------------------------------------------
1/1         sanFc1GbPort      up/up                     0
1/2         sanFc1GbPort      up/up                     0
2/1         sanFc1GbPort      up/up                     0
2/2         sanFc1GbPort      up/up                     0
3/1         sanFc1GbPort      up/up                     0
3/2         sanFc1GbPort      up/up                     0
4/1         sanFc1GbPort      up/up                     0
4/2         sanFc1GbPort      up/up                     0
8 records displayed
```

   The FC port (sanFc1GbPort) must be connected to a fibre-channel switch. In this case, the `show ioport` state will be "up/up." If you see "up/down," the cable might be disconnected from the port or the port is disabled on the remote switch. A fibre-channel port can auto negotiate its speed up to 1, 2, and 4 Gbps.

4. **Create a vHBA, bind it to the server profile, and specify a slot/port on which to terminate the vHBA:**

```
add vhba vhba1.myserver 2/1
```

   In this example, the vHBA is "`vhba1`" and the server profile is "`myserver`." The FC slot is "2," and the FC port is "1." When you add a vHBA and specify a termination point, a vHBA is created on the server automatically (assuming the correct host software is installed). If devices connect through that port, the hosts will begin to discover the targets.

5. **Define the target order (see "Persistent Binding" on page 142).**

   If you receive the error message "Invalid vhba name - parent does not exist", then the server profile was not created successfully.

6. **Repeat the steps again.**

Note – vHBAs must be distinct when created on distinct chassis. For example, you can not have VH1.SP1 on two different chassis that connect to one or more common servers.

---

7. **Verify the vHBA was created and its state is "up":**

```
show -list vhba vhba1.myserver
------------------------------------------------------------------
name            vhba1.myserver
state           up/up
fabric-state    initialized
if              2/1
if-state
wwnn            50:01:39:71:00:02:D1:1E
wwpn            50:01:39:70:00:02:D1:1E
map
lun-mask
local-id        0
------------------------------------------------------------------
1 record displayed
```

The state is "up" when the FC port is connected to a reachable FC switch.

If the state is "`resourceUnavailable`" there is no FC connection. This field also displays "`resourceUnavailable`" in cases when the server profile is not bound to a physical host resource, or the host cannot communicate.

There are three-levels of oper-status on the Oracle Fabric Interconnect: card, port, vhba.

The access-control zoning on the switch and LUN masking must be set up properly in advance. Go to the switch and verify the WWNs have logged in properly. Otherwise, you not see the appropriate devices via the vHBA in the CLI. When set up properly, the prescan feature enables an unbound vHBA to display the discovered targets and LUNs in the network environment. At this point, an unbound vHBA can be bound to a server profile. See "Target Prescan and Rescan" on page 146 for more information.

The Oracle Fabric Interconnect supports both port and soft zoning. In most cases, port zoning is preferred, but which method of zoning you will use in your SAN is matter of choice based on your knowledge of your SAN and how it is connected.

vHBA Attributes

Additional options are available for a vHBA through the `set vhba` command. These options allow for more customization of the vHBA than the basic configuration documented in the previous section.

Syntax

```
set vhba <vhba-name>.<profile-name> [<wildcard>] -descr=<text>
    -fabric-link-down-timeout={<value>|default} -if={<slot/port>|none}
    -lun-mask={<lun-mask>|none} -qos={<qos-profile-name>|none}
show vhba <vhba-name>.<profile-name> [<wildcard>] alarms [-detail]
show vhba <vhba-name>.<profile-name> [<wildcard>] errors [-detail]
show vhba <vhba-name>.<profile-name> [<wildcard>] qos [-detail]
show vhba <vhba-name>.<profile-name> [<wildcard>] stats [-detail]
show vhba <vhba-name>.<profile-name> [<wildcard>] throughput
show vhba <vhba-name>.<profile-name> [<wildcard>] warnings [-detail]
```

For information about displaying SAN QoS for a vHBA, see "SAN QoS for vHBAs" on page 209.

Parameter Description

Parameter	Description
`-descr=<text>`	Applies a text description to the vHBA. Quotes are required around multiple words containing spaces in between.
`-detail`	An optional modifier that allows displaying detailed information (if available) for the vHBA.
`-fabric-link-down-timeout`	Sets a value in milliseconds for the InfiniBand fabric to be down before the vHBA is put in operational state "down". Set a value between 0 and 255. The default is 0, which can be set through the number zero (0) or through the keyword default.

Parameter	Description
`-if`	Sets a termination slot and port for the vHBA. This option can be used to terminate the vHBA on a different Fibre Channel port if needed.
`-lun-mask`	Binds a LUN Mask to a vHBA. The LUN Mask must already exist for it to be available for binding. This option is useful for adding a LUN Mask to a vHBA after the vHBA is already created. For more information, see "LUN Masking" on page 169.
`-qos`	Binds a SAN QoS Profile to the vHBA. The SAN QoS Profile must already exist for it to be available for binding. This option is useful for adding a SAN QoS Profile to a vHBA after the vHBA is already created. For more information, see "SAN QoS for vHBAs" on page 209.
`<wildcard>`	Allows specifying selected wildcard characters (for example, *) to facilitate executing a command for one or more vHBAs.

vHBA State

You can control vHBA state by using the set vhba command to set the vHBA to either up down, or clear.

Parameter	Description
`set vhba <vhba-name> [<wildcard>] down`	Deactivates the vHBA. The vHBA can be explicitly named, or you can use a wildcard character (for example, *) to turn down all vHBAs.
`set vhba <vhba-name> [<wildcard>] up`	Brings the vHBA online. The vHBA can be explicitly named, or you can use a wildcard character (for example, *) to turn down all vHBAs.
`set vhba <vhba-name> [<wildcard>] clear`	Clears items from the vHBA and leaves it in whichever state it was in when you issued the clear command. The vHBA can be explicitly named, or you can use a wildcard character (for example, *) to turn down all vHBAs.

When you bring a vHBA online (up) it will attempt to discover all the attached targets that are available to it. You can also have the vHBA relearn attached targets without having to bring the vHBA down, then up. For information, see "Target Prescan and Rescan" on page 146.

Persistent Binding

A target is a storage device on a SAN. A target can be a single disk, or it can have many devices (LUNs or volumes) within it.

Users who bind targets to specific devices tend to also specify the scope and search order (persistent binding) of those devices. In OVN's application, persistent binding occurs within a vHBA. When a vHBA becomes active, it is working with many devices in the network (i.e., switch communication, fabric login, device discovery). The vHBA then presents this information to the remote OS. In order to preserve the remote OS' device-to-drive binding across each bring-up, the persistent binding setting is required.

By default, no persistent binding is assigned to a vHBA. When persistent binding is not configured, all the targets found for the vHBA are reported to the remote OS in a random order (first come first serve). Persistent binding specifies the exact order of the targets found.

Syntax

```
add san map <map-name> [<wildcard>] entry <order> <wwpn> [-noconfirm]
add vhba <vhba-name> <card>/<port> -map=<map-name>
show san map <map-name> [<wildcard>]|<map-name> entries
show vhba <vhba-name> [<wildcard>] -map=<map-name>
remove san map <map-name> [<wildcard>] [entry <order>]
```

Parameter Description

Parameter	Description
`add san map`	Creates an ordered mapping of devices identified by World Wide Port Names (WWPN). The vHBA uses these SAN map device IDs in this order. All devices discovered by XgOS are subject to this binding filter. Missing devices are skipped and no substitutes are made.
`<map-name>`	User-defined name for a map to configure on a new vHBA. A SAN map is the order in which the target disks come up (become active).
`<wildcard>`	Allows specifying selected wildcard characters (for example, *) to facilitate executing a command for one or more vHBAs.
`entry <order>`	Order number in the remote OS. The order range is from 0 to 255.
`entries`	Shows a table of all Persistent Mappings within a configured SAN Map. Persistent Mappings are listed numerically by the `Order` number assigned to each Persistent Map when it was created.
`<wwpn>`	World Wide Port Name. A 64-bit global address, where each number is delimited by colons (:).

Note – The persistent binding can only apply to the target's level but not to the Logical Unit Numbers (LUNs) level. Therefore, an array-ordering problem could arise in the network when a new LUN is added to the topology. In this case, the persistent binding would need to be redone.

▼ Configure Persistent Mapping for an Undeployed vHBA

A vHBA is considered deployed when it has been assigned to a slot/port and a server ID (a server profile that is bound to a host physical connection). The remote OS has already detected a specific target order. When a vHBA has already been deployed, XgOS disallows users from changing (setting) this target order dynamically (on-the-fly). Likewise, when a persistent mapping is already assigned to a vHBA, XgOS disallows users from modify that persistent mapping. You cannot add, delete, or modify specific entries. In summary, mapping can be specified only at vHBA creation time (when the add vhba command is issued).

Take the following steps to configure a persistent map (binding) for an undeployed vHBA.

1. **Add a named SAN map and specify its fixed WWPN target order. This example creates a SAN map with 8 targets:**

```
add san map mymap entry 0 21:00:00:20:37:C9:1D:C2
add san map mymap entry 1 21:00:00:20:37:D5:45:FD
add san map mymap entry 2 21:00:00:20:37:B3:F0:5C
add san map mymap entry 3 21:00:00:20:37:90:88:90
add san map mymap entry 4 21:00:00:20:37:C6:5E:B4
add san map mymap entry 5 21:00:00:20:37:CC:EB:30
add san map mymap entry 6 21:00:00:20:37:D5:37:18
add san map mymap entry 7 21:00:00:20:37:8D:03:7D
```

2. **Consider starting the entry order from 0 instead of 1 because the host OS uses 0 as the 1st order.**

3. **Verify the persistent map was configured correctly:**

```
show san map mymap
name                          descr              entries
-------------------------------------------------------------------
mymap                                         0=21:00:00:20:37:C9:1D:C2
                                              1=21:00:00:20:37:D5:45:FD
                                              2=21:00:00:20:37:B3:F0:5C
                                              3=21:00:00:20:37:90:88:90
                                              4=21:00:00:20:37:C6:5E:B4
                                              5=21:00:00:20:37:CC:EB:30
                                              6=21:00:00:20:37:D5:37:18
                                              7=21:00:00:20:37:8D:03:7D
1 record displayed
```

   You can omit the <map-name> to display information of all configured SAN maps.

4. **Create a server profile, a vHBA (not yet deployed), and bind them together with a persistent map:**

```
add server-profile myserver
add vhba vhba101.myserver -map=mymap
show vhba vhba101.myserver map
vhba                  name            descr     entries
-------------------------------------------------------------------
vhba101.myserver      mymap                     0=
21:00:00:20:37:C9:1D:C2
                                          1=21:00:00:20:37:D5:45:FD
                                          2=21:00:00:20:37:B3:F0:5C
```

```
                                                    3=21:00:00:20:37:90:88:90
                                                    4=21:00:00:20:37:C6:5E:B4
                                                    5=21:00:00:20:37:CC:EB:30
                                                    6=21:00:00:20:37:D5:37:18
                                                    7=21:00:00:20:37:8D:03:7D
1 record displayed
```

5. Bind the named server profile to a physical connection:

```
set server-profile myserver connect ceasar@iowa:ServerPort13
```

6. Bind the vHBA to a physical slot/port:

```
set vhba vhba101.myserver -if=1/1
```

At this point, the vHBA is bound to the persistent map named "mymap." When this vHBA finds its targets, the vHBA sends target information to the host along with the target order. The host driver receives the target information and propagates it up to the OS based on entry order in the map.

7. Check the targets of the newly bound vHBA:

```
show vhba vhba101.myserver targets
vhba                 name       wwnn                        wwpn                 luns
-------------------------------------------------------------------------------------
vhba101.myserver 20:00:00:20:37:8D:03:7D   21:00:00:20:37:8D:03:7D  0
vhba101.myserver 20:00:00:20:37:D5:37:18   21:00:00:20:37:D5:37:18  0
vhba101.myserver 20:00:00:20:37:CC:EB:30   21:00:00:20:37:CC:EB:30  0
vhba101.myserver 20:00:00:20:37:C6:5E:B4   21:00:00:20:37:C6:5E:B4  0
vhba101.myserver 20:00:00:20:37:90:88:90   21:00:00:20:37:90:88:90  0
vhba101.myserver 20:00:00:20:37:B3:F0:5C   21:00:00:20:37:B3:F0:5C  0
vhba101.myserver 20:00:00:20:37:D5:45:FD   21:00:00:20:37:D5:45:FD  0
vhba101.myserver 20:00:00:20:37:C9:1D:C2   21:00:00:20:37:C9:1D:C2  0
8 records displayed
```

This command will not list the targets by the order specified in the persistent mapping. If you want to verify this order, you need to check the host side.

Example: Configure Persistent Mapping While Creating a vHBA

The persistent binding can be assigned while creating a vHBA, which is provided to you as a configuration convenience:

```
add server-profile myserver ceasar@iowa:ServerPort13
add vhba vhba999.myserver 4/1 -map=mymap
```

Example: Remove vHBA, Server Profile, and SAN Map

To remove a vHBA, server profile, and SAN map in the correct order:

```
remove -noconfirm vhba vhba101.myserver
remove -noconfirm server-profile myserver
remove -noconfirm san map mymap
```

As an option, if you only want to remove "mymap", you need to remove the associated vHBA. Skip the 2nd step (removal of `myserver`) as shown.

To check if any SAN map is remaining:

```
show san map
Nothing to display
```

Note – Expect an error if you remove a SAN map without first unbinding the vHBA `remove -noconfirm san map mymap`: "Commit failed: Cannot delete Persistent Mapping Set :mymap. Currently in use by Vhba: vhba101 (error 111)."

Target Prescan and Rescan

Target `prescan` and `rescan` enables you to discover the available target and LUN information on the network without requiring a host server to be bound to the Oracle Fabric Interconnect. Use this feature to determine if the list of targets and LUNs are satisfactory, or require any removals or additions, before committing them (binding) to a host-server profile. XgOS then supports binding the server profile with the phys-con after a prescan is complete.

The Oracle Fabric Interconnect relies on fibre channel's Registered State Change Notification (RSCN) to send target-state updates from the remote switch to the Oracle Fabric Interconnect. The Oracle Fabric Interconnect's IOP learns the update and notifies the host server of any changes. However note that RSCN is turned off by default on some fibre-channel switches.

RSCN does not support reporting LUN state changes (add or remove). To compensate for this RSCN limitation, you must manually run `rescan` for a vHBA to detect any LUN level changes.

Syntax

```
set vhba <vhba-name>.<server-profile> [<wildcard>] prescan
set vhba <vhba-name>.<server-profile> remove-prescan
set vhba <vhba-name>.<server-profile> rescan
show vhba <vhba-name>.<server-profile> [<wildcard>] targets [-detail]
```

Parameter Description

Parameter	Description
`-detail`	An optional modifier that allows displaying detailed information (if available) for the vHBA.
`prescan`	Configures prescan state for an unbound vHBA.
`remove-prescan`	Removes a prior configured prescan state, which is required in order to re-issue a new prescan state. Once you issue a prescan, the configuration resides on the I/O card. The system is incapable of receiving any LUN changes through RSCN. You can issue prescan several times, but, to detect LUN changes, the prior prescan state must be removed (`remove-prescan`) from the vHBA before you can prescan again.
`rescan`	Configures rescan state for a bound vHBA. RSCN does not support reporting LUN state changes. Because of this RSCN limitation, you must manually run `rescan` for a vHBA to detect LUN changes. When running rescan, if any vHBAs are in `down` state, the rescan process runs to completion then displays the vHBAs in down state.
`targets`	Displays the storage targets attached to a vHBA.
`<wildcard>`	Allows specifying selected wildcard characters (for example, *) to facilitate executing a command for one or more vHBAs.

▼ Enable prescan

To enable prescan for an unbound vHBA:

1. **Create an unbound server profile, where the state is "unassigned":**

```
add server-profile III
show server-profile III
------------------------------------------------------------
name         III
state        up/unassigned
...
```

2. **Create a vHBA under this unbound server:**

```
add vhba vhbaiii.III 4/1
```

At this point, show vhba <vhba-name>.<server-profile> will report the state as "resourceUnavailable," which is expected. The vHBA is not bound to a server.

3. **Set this vHBA to prescan state, which propagates target discovery to the FC I/O card (sanFc2Port4GbLrCard) on the Oracle Fabric Interconnect:**

```
set vhba vhbaiii.III prescan
```

4. **Display the discovered targets and LUNs in the network environment. If you add or remove a target on the array side, those changes will be reflected accordingly on the Oracle Fabric Interconnect through RSCN:**

```
show vhba vhbaiii.III targets
vhba       name  wwnn                      wwpn                      lun-ids
-------------------------------------------------------------------------
vhbaiii.III      2F:9F:00:06:2B:10:C3:BA  2F:9F:00:06:2B:10:C3:BA  3,2,1,0
vhbaiii.III      2F:BF:00:06:2B:10:C3:BA  2F:BF:00:06:2B:10:C3:BA  3,2,1,0
vhbaiii.III      2F:DF:00:06:2B:10:C3:BA  2F:DF:00:06:2B:10:C3:BA  3,2,1,0
vhbaiii.III      2F:FF:00:06:2B:10:C3:BA  2F:FF:00:06:2B:10:C3:BA  3,2,1,0
4 records displayed

show vhba vhbaiii.III
------------------------------------------------------------------------
name          vhbaiii.III
state         resourceUnavailable
fabric-state  uninitialized
if            4/1
if-state      down
wwnn          50:01:39:71:00:00:F1:02
```

```
wwpn          50:01:39:70:00:00:F1:02
map
lun-mask
local-id      0
------------------------------------------------------------------------
1 record displayed
```

▼ Bind After `prescan`

The ideal scenario is to bind the prescan-discovery results to a host server. XgOS supports binding the server profile with the phys-con after a prescan is complete, as long as you follow the correct configuration order.

Follow these steps to perform a prescan then bind the server profile:

1. **Create an unbound server profile:**

```
add server-profile III
```

2. **Create a vHBA under this unbound server:**

```
add vhba vhbaiii.III 4/1
```

3. **Set this vHBA to prescan state:**

```
set vhba vhbaiii.III prescan
```

4. **Display the targets:**

```
show vhba vhbaiii.III targets
```

   From now on if there are any RSCN changes, the targets will also be updated accordingly.

Note – At this point, you can also specify the target order by integrating persistent mapping with prescan. See "Persistent Binding" on page 142. If you do, be sure to issue `remove-prescan` before binding.

---

5. **If you are satisfied with the results, bind the** `server-profile`**:**

```
set server-profile III connect titan@ServerPort23
```

From now on, this vHBA has become a normal vHBA. You can run rescan against it:

```
set vhba vhbaiii.III rescan
```

Note – You can no longer run `prescan` against this normal vHBA.

Example: `remove-prescan`

You can issue prescan several times. However to detect LUN changes, the prior prescan state must be removed (`remove-prescan`) from the vHBA before you can re-issue prescan again:

```
set vhba vhbaiii.III remove-prescan
set vhba vhbaiii.III prescan
show vhba vhbaiii.III targets
```

▼ Detect LUN Changes `rescan`

RSCN does not support reporting LUN state changes. For the Oracle Fabric Interconnect to detect LUN changes, you must manually run `rescan` for a vHBA. The rescan process runs to completion, then displays information for all vHBAs in `down state`.

To detect LUN changes for a bound (normal) vHBA:

1. **Create a bound server profile:**

```
add server-profile titan titan@ServerPort23
```

2. **Create a vHBA under this bound server:**

```
add vhba vhba888.titan 4/1
```

3. **Display the targets:**

```
show vhba vhba888.titan targets
```

4. **Configure this vHBA to rediscover (rescan state) the available LUN information.**

   If there are any LUN changes, they will be reflected after this `rescan` operation:

```
set vhba vhba888.titan rescan
```

5. **Display any new target and LUN information:**

```
show vhba vhba888.titan targets
```

Set FC Card Attributes

You can control the Fibre Channel card operational state through the `set fc-card` command. Commands that affect card state also affect the FC ports on the cards, and in turn, the vHBAs that are supported on the port.

Syntax

```
set fc-card {*|<slot>} down [-descr=<text>]
set fc-card {*|<slot>} reset [-descr=<text>]
set fc-card {*|<slot>} up [-descr=<text>]

show fc-card {*|<slot>} dmesg
show fc-card {*|<slot>} errors
show fc-card {*|<slot>} ioport <port-number> [<wildcard>]
show fc-card {*|<slot>} ioports
show fc-card {*|<slot>} qos
show fc-card {*|<slot>} stats
show fc-card {*|<slot>} utilization
show fc-card {*|<slot>} vhbas
show fc-card {*|<slot>} warnings

watch fc-card {*|<slot>}
watch fc-cards
```

Parameters

Parameter	Description
`*|<slot>`	Specifies the physical slot to which the command will be applied. An asterisk (*) specifies all available FC cards.
`-descr=<text>`	Applies a text description to the FC module. Quotes are required around multiple words containing spaces in between.
`<port-number>`	Specifies a particular Fibre Channel port for which information will be displayed.
`<wildcard>`	Allows specifying selected wildcard characters (for example, *) to facilitate executing a command for one or more vHBAs.

Example: Display FC Cards

Display the properties of all Fibre Channel cards.

```
show fc-card
slot    state    descr   type                 vhbas    qos enables
-------------------------------------------------------------------
1      up/up            sanFc2Port4GbLrCard 9           -
8      up/up            sanFc2Port4GbLrCard 4       10  q
2 records displayed
```

Example: Display FC Card Utilization

Memory utilization is available for fibre channel cards. By displaying memory utilization, you can get information about how much of the FC card's processing power is being used by different processes. The utilization numbers are for the entire card and all vHBAs terminated on it. Display the utilization by issuing the `show fc-card <number> utilization` command.

```
show fc-card 8 utilization
name total-util   no-rsrs-p0 no-rsrs-p1 no-read-mem no-write-mem
-------------------------------------------------------------------
8    48900050    990       40          0           0
1 record displayed
```

Watch FC Card Utilization

With the `watch fc-card` command, you can run a command that continuously updates the Fibre Channel card utilization over a period of time. The `watch fc-card` command (and `watch fc-cards`) will intermittently poll the Fibre Channel card and display the updated, real-time statistics automatically. The polling window is fixed (not configurable), and the command is useful for seeing how the card is being used as well as viewing trends in usage over time.

Display continuous FC card utilization for a single card by issuing the `watch fc-card` command. For all FC cards, use the `watch fc-cards` command.

```
watch fc-card 9
IOCard measured in bytes                          Wed Jul  6 16:56:08 PDT 2011
name        type                      state       util        util-stats
-------------------------------------------------------------------------------
9           sanFc2Port4GbCard         up          0
1 record displayed
```

Set FC Port Attributes

Each FC port is controlled by a back-end logic chip, and a set of attributes and properties can be controlled from the command line. Some of the attributes are displayed only when using the `-detail` argument for `show fc port`:

```
-------------------------------------------------------------------
name                            4/2
type                            sanFcPort
state                           up/down
descr
wwnn                            50:01:39:71:00:00:B0:21
wwpn                            50:01:39:70:00:00:B0:21
rate                            auto/0
frame-size                      2048/2048
exec-throttle                   65535
int-delay                       1000
fc-link-down-timeout            30
login-retry                     8
login-timeout                   4
fc-target-port-down-timeout     30
topo                            F
loop-delay                      5
tape-support                    true
```

```
vhbas                          1
-------------------------------------------------------------------
1 record displayed
```

The most commonly used fibre-channel controls are rate, topology (`topo`), frame-size, and execution-throttle. However, note that modified attributes do not take effect until you reset the I/O card. See the example that follows.

Syntax

```
set fc-port {*|<slot>/<port>} -descr=<text>
set fc-port {*|<slot>/<port>} -fc-link-down-timeout={<number>|default}
set fc-port {*|<slot>/<port>} -fc-target-port-down-timeout={<number>|default}
set fc-port {*|<slot/<port>>} -topology={f-port|l-port|n-port}

show fc-port {*|<slot>/<port>} [-detail]
show fc-port {*|<slot>} alarms [-detail]
show fc-port {*|<slot>} qos [-detail]
show fc-port {*|<slot>} stats [-detail]
show fc-port {*|<slot>} vhbas [-detail]
```

Note – Some port parameters (for example, topology mode) are displayed only through the `-detail` option.

Parameter Description

Note – The `set fc-port` commands have been implemented with defaults that are useful for most deployments. As a result, typically you do not need to change the FC port parameters. However, the `set fc-port` commands do support setting custom values. Oracle recommends that you use the default values for FC port parameters, and change them only if absolutely required.

Parameter	Description
`-descr=<text>`	Applies a text description to the FC port. Quotes are required around multiple words containing spaces in between.
`-detail`	Enables you to display detailed information about the Fibre Channel port configuration, properties, and state. Some Fibre Channel port parameters are displayed only through this option.
`-fc-link-down-timeout={<number>|default}`	When a fibre link goes down, the FC port will wait (delay) the specified number of seconds before declaring the fibre link down. This parameter value in seconds that determines the duration for which a link can experience a loss of signal, or be non-operational before the firmware declares the link is down and sends a link down event. This parameter guards against link flapping and excessive reporting of link-state changes whenever there is a constant change in the state of the link. Specify a number of seconds between 0 and 60, or do not specify any millisecond value to use the default time-out. The default is 30 seconds.
`-fc-target-port-down-timeout={<number>|default}`	When a Fibre Channel port goes down on a target, the Oracle Fabric Interconnect will wait (delay) the specified of seconds before declaring the port down. This parameter is a counter that determines the maximum number of seconds a port can remain offline. If the specified number of seconds is exceeded, the port is timed out and declared down. Specify the time-out value as a number of seconds between 0 and 60, or do not specify any number to use the default retry limit. The default limit is 30 seconds.

Parameter	Description
`-topology={f-port|l-port|n-port}`	Specifies the type of storage connection to be used. The following parameters are supported: • `f-port` specifies a point-to-point connection to the storage device through a Fibre Channel switch. This type of connection supports *NPIV*. This is the default configuration for a Fibre Channel I/O module. • `l-port` specifies a loop connection to the storage device without using a Fibre Channel switch. This type of connection does not support NPIV. A port configured this way can support only a single vHBA. • `n-port` specifies a point-to-point connection to the storage device without using a Fibre Channel switch. This type of connection supports NPIV.
`*|<slot>/<port>`	The physical slot and port coordinate to be configured. An asterisk (*) specifies all available FC cards.

Example: Set the Link Down Time-Out

Note that modified settings do not become effective until you reset the I/O card. To adopt new settings, the card must be brought down, rebooted, and re initialized using the `set iocard` command:

```
show ioport
name     type                  state       descr     vnics     vhbas
-------------------------------------------------------------------
4/1      sanFc1GbPort           up/down                0         0
4/2      sanFc1GbPort           up/up                  0         4
5/1      sanFc1GbPort           up/up                  0         1
5/2      sanFc1GbPort           up/up                  0         0
9/1      nwEthernet10GbPort     up/up                  0         0
5 records displayed
set fc-port 4/2 -fc-link-down-timeout=10
set iocard 4 down
Shutting down IO cards will adversely affect any virtual IO
resource connected to them and thus cut IO to the physical servers.
Are you sure you want to shutdown the IO card in slot 4 (y/n)?y
set iocard 4 up
show ioport 4/1 -detail
-------------------------------------------------------------------
name                          4/1
```

```
type                            sanFcPort
state                           up/up
descr
wwnn                            50:01:39:71:00:00:B0:1F
wwpn                            50:01:39:70:00:00:B0:1F
rate                            auto/4Gbps
frame-size                      2048/2048
exec-throttle                   65535
int-delay                       1000
fc-link-down-timeout            10
login-retry                     8
login-timeout                   4
fc-target-port-down-timeout     60
topo                            F
loop-delay                      5
tape-support                    true
vhbas                           4
-------------------------------------------------------------------
1 record displayed
```

▼ Configure a Port for Direct-Attached Storage

The Oracle Fabric Interconnect supports direct-attached storage. To configure a port for such storage:

1. **Set the desired port type.**

   For example, to configure port 1 on I/O module 3 as an “l” port:

```
set fc-port 3/1 -topology=l-port
```

2. **Reset the I/O card to make your change take effect.**

   For example:

```
set fc-card 3 reset
```

   You can configure each port on a card differently. Issue the reset command after making all port configuration changes.

   If you are reconfiguring a port, remove all but one vHBA from that port. Then follow the steps above to configure the port for direct-attached storage.

Note – When you configure a LUN on this direct-attached device, you will see the WWPN of the port, not of the vHBA.

Removing vHBAs

To support the graceful deletion of vHBAs, you must follow the documented procedures. Failure to do so might cause instability on the host server.

General Procedure

In general, the process of removing a vHBA is the same for every situation:

1. On the host server, stop I/O that uses the vHBA that you want to delete.
2. On the Oracle Fabric Interconnect, remove the vHBA.
3. For example, to delete the vHBA named `news_storage`:

```
remove vhba news_storage
```

Environments Where the General Procedure Applies

You can use the general procedure if you are removing a vHBA:

- Connected to a native Linux or Windows server (not a VMware virtual machine) with no file system mounted and no other special circumstances (see "Procedures for vHBA Delete in Special Environments" on page 159 for specialized instructions).
- Used for SAN boot, so long as the vHBA is not providing access to the root partition.

Note – You cannot remove a vHBA that provides the root partition in a SAN boot environment. If you attempt to remove the vHBA, the server will behave unpredictably.

- Connected to a non-multipath Linux server.
- That mount a file system for a Windows server.
- Connected to a Windows multipathing server.
- When you are migrating a server-profile.
- Changing a server-profile configuration deletes all the vNICs and vHBAs contained in the profile.

Environments Where Special Procedure is Required

If the vHBA is in any of the following environments, use the specialized instructions listed in "Procedures for vHBA Delete in Special Environments" on page 159:

- vHBAs connected to any VMware virtual machine.
- vHBAs in a Linux multipathing environment.
- vHBAs that mount a file system for a Linux server.

Caution – If your vHBA is in any of these special situations, do not use the general procedure. If you do, you risk causing instability in the server.

Procedures for vHBA Delete in Special Environments

In most circumstances, removing a vHBA requires special steps not presented in the general procedure. If your vHBA is used in any of the following environments, you must use the procedure listed in the following table.

For Removing a vHBA	Follow the Instructions in this Procedure
From an ESX VMware machine using VMFS	"Removing vHBAs Connected to Virtual Machines Using VMFS" on page 160
From an ESX VMware machine using Linux disk access	"Removing vHBAs Connected to Linux Servers" on page 161
From an ESX VMware machine using Windows disk access	"Removing vHBAs Connected to Windows Servers Hosted in VMware" on page 162
In a Linux multipathing environment	"Removing vHBAs in a Linux Multipath Environment" on page 163
That mounts a file system for a Linux server	"Removing vHBAs Connected to Linux Servers" on page 161

Syntax

```
remove vhba <vhba-name>.<server-name> [<wildcard>] [-noconfirm]
```

Remove vHBAs Connected to VMware Virtual Machines

OVN supports VMware ESX, which is documented in the following procedures for removing vHBAs on virtual machines. Select one of the following:

- If you are using VMFS, follow the instructions in "Removing vHBAs Connected to Virtual Machines Using VMFS" on page 160.
- If you are using raw disk access and Linux virtual machines, follow the instructions in "Removing vHBAs Connected to Linux Servers" on page 161.
- If you are using raw disk access and Windows virtual machines, follow the instructions in "Removing vHBAs Connected to Windows Servers Hosted in VMware" on page 162.

▼ Removing vHBAs Connected to Virtual Machines Using VMFS

Use the following procedure to gracefully remove a vHBA:

1. **On the virtual machine, stop all I/O on the vHBA that you want to remove.**
2. **Use one of the following approaches to stop I/O:**
   - Shut down the virtual machine.

Note – Shutting down the virtual machine ensures that even the VMware heartbeat is stopped on the vHBA. If you cannot shut down the machine, using VMotion will handle all traffic except the heartbeat. If you choose this approach, you might notice errors in the log indicating that the vHBA was unavailable.

   - Use VMotion to move the machine to another server.
3. **Remove the vHBA.**

   For example, to delete the vHBA named `news_storage`:

```
remove vhba news_storage
```

Note – Changing the storage configuration when using VMware might require a rescan to discover those changes and propagate them to the ESX GUI.

Remove vHBAs Connected to Servers Using Direct Disk Access

Use the following procedures for removing vHBAs when the host server is accessing the storage directly. These procedures apply to regular Linux servers and to VMware virtual Linux and Windows servers that do not use VMFS.

Note – For regular Windows servers, use the general procedure as listed in "General Procedure" on page 158.

▼ Removing vHBAs Connected to Linux Servers

This procedure applies to regular Linux servers and to virtual Linux servers under VMware that do not use VMFS. Use the following procedure to gracefully remove the vHBA:

1. **On the host server, stop all I/O on the vHBA that you want to remove.**
2. **Stop all applications that might attempt to access storage over the vHBA.**
3. **If you have a file system mounted, unmount the volume by using the Linux** `umount` **command.**

   For example, to unmount the /home volume:

```
umount /home
```

4. **Remove the vHBA.**

   For example, to delete the vHBA named `news_storage`:

```
remove vhba news_storage
```

5. **If appropriate, mount the volume by using the Linux** `mount` **command.**

   For example, to mount the device /deva/lun27 as /home:

```
mount /deva/lun27 /home
```

Note – Changing the storage configuration when using VMware might require a rescan to discover those changes and propagate them to the ESX GUI.

▼ Removing vHBAs Connected to Windows Servers Hosted in VMware

This procedure applies only to Windows virtual machines that do not use VMFS to access storage. For regular Windows servers, use the general procedure as listed in "General Procedure" on page 158.

Use the following procedure to gracefully remove the vHBA:

1. **On the Windows server, stop all I/O on the vHBA that you want to remove.**
2. **Shut down any applications that might attempt to access storage over the vHBA. Close any windows such as command prompts, Explorer windows, and shares that are accessing the storage volume.**
3. **Disable the vHBA on the server:**
4. **Run the Computer Management application by selecting Start->Run and entering compmgmt.msc at the command prompt.**
5. **Click Ok.**
6. **In the Computer Management window, click Device Manager.**
7. **Expand SCSI and RAID controllers.**
8. **Right-click on the entry for the vHBA that you want to delete and select Uninstall.**
9. **Confirm the uninstall.**

   If you get a prompt to reboot the Windows server, the vHBA is still in use and cannot be removed. Click Cancel and confirm that no applications are using the storage resources on the vHBA.

   For example, check for open command prompts to the disk, no Windows Explorer windows open displaying the disk, no users or shares connected to the disk. Then uninstall the vHBA by performing Step 3 again.

10. **Log in to the I/O Director.**

    For example, from a secure command prompt, enter the following:

```
ssh admin@<address>
Password: <password>
```

    where <*address*> is the IP address of your Oracle Fabric Interconnect and <*password*> is your administrator account password.

11. **On the Oracle Fabric Interconnect, remove the vHBA.**

    For example, to delete the vHBA named `news_storage`:

```
remove vhba news_storage
```

Note – Changing the storage configuration when using VMware might require a rescan to discover those changes and propagate them to the ESX GUI.

Removing vHBAs in a Linux Multipath Environment

OVN supports multipathing through EMC PowerPath software, which is documented in the following procedures for illustrative purposes. Follow the instructions in "Removing a vHBA and Rebooting the Server" on page 163 if rebooting the host server is not a problem in your network. If you need to maintain service while making your changes, follow the instructions in "Removing a vHBA While Maintaining Service" on page 164.

▼ Removing a vHBA and Rebooting the Server

You can use the following procedure to gracefully remove the vHBAs from a Linux server using multipathing. This procedure is the quickest and easiest method of removing vHBAs because it concludes with a reboot of the host server. Rebooting the server causes the vHBA driver to be reloaded into the server memory, which will in turn trigger an automatic rescan of the storage network to learn the changes among devices.

This procedure is useful for host servers that are not running mission-critical applications, or that are running applications that can tolerate a short span of service interruption due to a reboot of the host server. This procedure can be useful when you are first bringing a server online and no other services are running.

Note – Rebooting the server will cause service interruptions for any running applications, so this procedure is recommended only for host servers that are running non-mission critical applications. If your host server cannot be rebooted, see "Removing a vHBA While Maintaining Service" on page 164.

To gracefully remove a vHBA from a Linux host server in a multipathing environment, perform the following steps:

1. **On the host server, stop all I/O on the vHBA that you want to remove.**
2. **Shut down all applications that might be using storage resources through the vHBA.**
3. **On the host server, unmount all file systems attached to the Xsigo vHBA:**

```
umount <device>
```

4. **On the host server, stop the PowerPath service by issuing either of the following commands:**

- `/etc/init.d/PowerPath stop`
- `service PowerPath stop`

5. **On the Oracle Fabric Interconnect, remove the vHBA.**

   For example, to delete the vHBA named `news_storage`:

```
remove vhba news_storage
```

6. **Reboot the host server.**

   This step loads the vHBA driver into memory, triggers the rescan, and restarts PowerPath.

▼ Removing a vHBA While Maintaining Service

The procedure in this section is recommended for host servers that are running mission-critical applications or applications that you do not want interrupted. This procedure does not involve a host server reboot. Instead, it unloads the vHBA driver from memory, then reloads the driver. When the driver is reloaded, a rescan is triggered.

This case is useful for situations where the host server has already booted and the vHBA drivers have been loaded into the host server's memory at least once. By unloading and loading the vHBA driver, you trigger a rescan so that storage device changes are relearned.

To gracefully delete a vHBA connected to a Linux host server in a multipath environment, follow this procedure:

1. **On the host server, stop all I/O on the vHBA that you want to remove.**
2. **Shut down all applications that might be using storage resources through the vHBA.**
3. **On the host server, unmount all file systems attached to the Xsigo driver.**

```
umount <device>
```

4. **On the host server, stop the PowerPath service by issuing either of the following commands:**
   - `/etc/init.d/PowerPath stop`
   - `service PowerPath stop`
5. **On the Oracle Fabric Interconnect, remove the vHBA.**

   For example, to delete the vHBA named `news_storage`:

```
remove vhba news_storage
```

6. **On the host server, unload the Xsigo vHBA driver:**

```
modprobe -rv vhba
```

7. **On the host server, load the Xsigo vHBA driver:**

```
modprobe -v vhba
```

Note – This step reloads the vHBA driver and triggers a rescan of the storage accessible through the vHBA.

---

8. **Start the PowerPath service, by issuing either of the following commands:**
   - `/etc/init.d/PowerPath start`
   - `service PowerPath start`

▼ Removing a vHBA Without Reloading vHBA Drivers

If you are making certain changes in storage, but want to reuse the vHBA drivers that are already loaded in to the server's memory, you can do so. This procedure enables you to remove the vHBAs, make the change to the storage devices, then

manually rescan without having to unload vHBA drivers from the host server, then reload them. This procedure is useful in situations when you are making minor changes to the storage network—for example, adding disks to a JBOD—instead of adding, deleting, or changing entire devices.

Note – You cannot use this procedure if your server is SAN-booted because this procedure requires the `xsigo-scan -r` command, which removes all devices including the SAN boot device. If your server is SAN-booted, use one of the other vHBA remove procedures in this chapter to remove vHBAs.

To gracefully delete a vHBA connected to a Linux host server in a multipath environment, follow this procedure:

1. **On the host server, stop all I/O on the vHBA that you want to remove.**
2. **Shut down all applications that might be using storage resources through the vHBA.**
3. **On the host server, unmount all file systems attached to the Xsigo vHBA:**

```
umount <device>
```

4. **On the host server, stop the PowerPath service by issuing either of the following commands:**
   - `/etc/init.d/PowerPath stop`
   - `service PowerPath stop`
5. **On the Oracle Fabric Interconnect, remove the vHBA.**

   For example, to delete the vHBA named `news_storage`:

```
remove vhba news_storage
```

6. **Make the host-side configuration change(s).**
7. **On the host server, rescan all the devices connected to the Xsigo vHBA:**

```
# /usr/bin/xsigo-scan -r -a
=======================================================
!!! Warning: This may affect the IO currently running
=======================================================
Do you want to continue: (Y/y/N/n)? y
----------------------
Devices Added: 0
----------------------
Devices Removed: 0
```

8. **On the host server, start the PowerPath service, by issuing either of the following commands:**
   - `/etc/init.d/PowerPath start`
   - `service PowerPath start`

vHBA Statistics

Operational and performance statistics are available for individual vHBAs through the `show vhba` command (as shown in the following example).

```
show vhba vhba1.crawford stats
------------------------------------------------------------------
name                                  vhba1.crawford
total-io                              27136
read-byte-count                       3380540138
write-byte-count                      0
outstanding-request-count             0
io-request-count                      27136
read-request-count                    27042
write-request-count                   0
task-management-request-count         94
target-count                          36
lun-count                             0
xsmp-xt-down-count                    3
xsmp-xt-oper-state-request-count      4
map-fmr-count                         27042
ummap-fmr-count                       27042
used-map-fmr-count                    0
abort-command-count                   0
reset-lun-command-count               0
reset-target-command-count            0
reset-bus-command-count               0
link-down-count                       1
disc-info-update-count                3
target-lost-count                     0
target-found-count                    0
cqp-disconnect-count                  4
dqp-disconnect-count                  4
cqp-ib-snd-err-count                  1
dqp-ib-snd-err-count                  0
cqp-ib-rcv-err-count                  0
dqp-ib-rcv-err-count                  0
cqp-ib-remote-disconnect-err-count    0
```

```
dqp-ib-remote-disconnect-err-count  0
------------------------------------------------------------------
1 record displayed
```

You can also display vHBA statistics for multiple vHBAs through the use of the `<wildcard>` option (for example `show vhba <wildcard> stats` command.

Fibre Channel Monitoring

Use `show fc-port` to display Fibre Channel port information. Use `set fc-port` to control the Fibre Channel port settings. See "Set FC Port Attributes" on page 153.

Syntax

```
show fc-port
show fc-port {*|<slot>/<port>} [-detail]
show fc-port {*|<slot>/<port>} [alarms] [qos] [stats] [vhbas] [-detail]
```

Example

```
show fc-port
name type      state   descr wwnn wwpn vhbas
------------------------------------------------------------------
8/1 sanFcPort up/up 50:01:39:71:00:00:80:49 50:01:39:70:00:00:80:49 0

show fc-port 8/1 -detail
-----------------------------------------------------------
name                          8/1
type                          sanFcPort
state                         up/up
descr                         for Pubs testing
wwnn                          50:01:39:71:00:00:80:47
wwpn                          50:01:39:70:00:00:80:47
rate                          auto/0
frame-size                    2048/2048
exec-throttle                 65535
int-delay                     1000
fc-link-down-timeout          20
login-retry                   8
login-timeout                 4
```

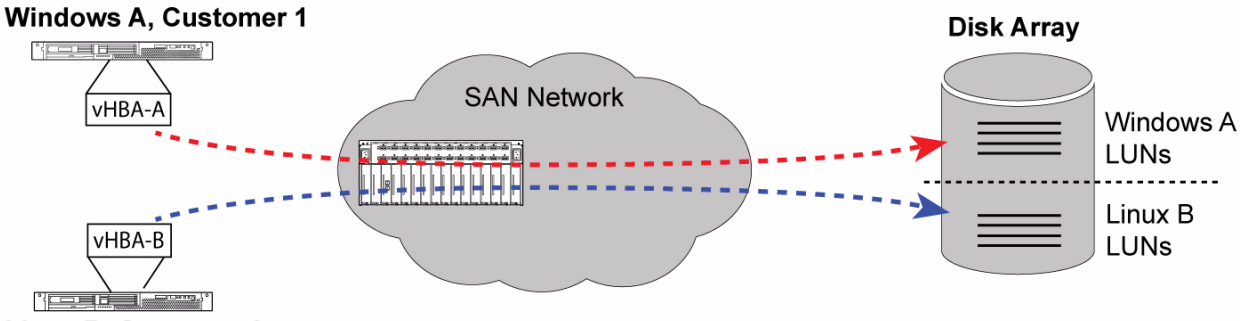
```
fc-target-port-down-timeout  60
topo                         F
loop-delay                   5
tape-support                 true
vhbas                        1
------------------------------------------------------------
1 record displayed

show fc-port 8/1 stats
------------------------------------------------------------------------
name                         8/1
controller-errs              0
device-errs                  0
link-fails                   0
loss-of-syncs                1
loss-of-signals              0
primitive-seq-protocol-errs  0
transmission-word-errs       0
crc-errs                     0
------------------------------------------------------------------------
1 record displayed
```

LUN Masking

Logical Unit Number (LUN) masking is an authorization feature that makes LUNs available to some vHBAs but not to others. When you apply a LUN mask to a vHBA, only that one vHBA on the host can detect the LUNs.

The standard location to configure LUN masking is on the disk array itself. In OVN's implementation, the Oracle Fabric Interconnect configures LUN masking in a centralized SAN location—the vHBA (not the disk array):



In this figure, the Oracle Fabric Interconnect controls which LUNs can be seen by the vHBAs. To accomplish this, the Oracle Fabric Interconnect deploys different vHBA policies (vHBA-A, vHBA-B) to maintain LUN security. When a vHBA is created, a different LUN mask is assigned.

RSCN does not report LUN state changes. Whenever the LUN masking changes on an existing vHBA, you must also issue a `rescan` on the Oracle Fabric Interconnect to send an RSCN update. See "Parameter Description" on page 171 for details.

When LUN masking is enabled, the SCSI "report luns" command will be intercepted and processed by the vHBA host software and Oracle Fabric Interconnect. For more details, see "Optional LUN Masking: No Report LUN Interception" on page 174.

If a storage controller fails to register its new LUN settings with the fibre channel fabric name server, you might have to trigger an RSCN in addition to the rescan on the Oracle Fabric Interconnect.

Note – Windows-based servers attempt to write volume labels to all available LUNs. This action can render the LUNs unusable by other operating systems and can result in data loss.

Syntax

```
add san lun-mask <mask-name> [<wildcard>] target <wwpn>
    lun {<lun-range>|all|none}
add vhba <vhba>.<server-profile> <slot>/<port>
    {-lun-mask=<mask-name>|-no-lun-masking|none}
set vhba <vhba-name>.<server-name> {-lun-mask=<mask-name>|none}
show vhba <vhba>.<server-profile> [<wildcard>]
    -lun-mask={<mask-name>|none} [-detail]
show vhba <vhba>.<server-profile> [<wildcard>] targets [-detail]
```

By default LUN masking is not applied to a vHBA. All LUNs are visible by default.

Parameter Description

Parameter	Description
`add san lun-mask <mask-name> target <wwpn> <lun-range>`	A named SAN LUN mask to create. A tuple of target WWPN and LUN IDs is required. A `<lun-range>` can be a single LUN ID or a range of LUN IDs. The range may contain multiple LUN IDs separated by commas or continuous IDs separated by a colon. For example 1,5,6:9,34 means LUN IDs 1,5,6,7,8,9,34. A `set vhba rescan` is required each time LUN IDs change. You can also use the `all` or `none` keyword to control the number of LUNs that will be masked.
`add vhba <vhba>.<server-profile> <slot>/<port> -lun-mask=<mask-name>`	Creates a vHBA and specifies a LUN mask to be seen. Only these LUNs are allowed to be discovered over this vHBA. You can also use the `-no-lun-masking` argument to add a LUN mask with the no LUN reporting option. For more information about using `-no-lun-masking`, see "Optional LUN Masking: No Report LUN Interception" on page 174.
`set vhba <vhba>.<server-profile> <slot>/<port> -lun-mask=<mask-name>`	Adds a LUN mask to an existing vHBA. You can also use the keyword none to remove a LUN Mask from a vHBA. This might require a rescan on the vHBA.
`show vhba <vhba>.<server-profile> -lun-mask`	Displays configured LUN mask information.
`show vhba <vhba>.<server-profile> targets`	Verifies if your LUN masking is working.

▼ Set a LUN Mask

1. **Create a LUN Mask named "`oracle-mask`" with target WWPN "`20:70:00:C0:FF:0A:81:30`" and LUN ID "`11`":**

```
add san lun-mask oracle-mask target 20:70:00:C0:FF:0A:81:30 11
```

2. **Create a server profile and bind it to a physical connection:**

```
add server-profile testlin2 testlin2@washington:ServerPort13
```

3. **Create a vhba and bind the LUN Mask "`oracle-mask`" to it:**

```
add vhba oracle-vhba1.testlin2 1/1 -lun-mask=oracle-mask
```

Now check to see the mask is correct. From the following output, we see the target is masked with LUN 11. LUN 0 is always shown. In case no physical LUN 0 was created, it will be a synonym of storage controller:

```
show vhba oracle-vhba1.testlin2 targets
vhba              name  wwnn                    wwpn                          lun-ids
-------------------------------------------------------------------------------------
oracle-vhba1.testlin2  20:70:00:C0:FF:0A:81:30   20:70:00:C0:FF:0A:81:30    11,0
1 record displayed
```

In case the storage device has two targets and each target has multiple LUNs, we will see:

```
show vhba oracle-vhba1.testlin2 targets
vhba              name   wwnn                wwpn                          lun-ids
-------------------------------------------------------------------------------------
oracle-vhba1.testlin2  20:70:00:C0:FF:0A:81:30  20:70:00:C0:FF:0A:81:30   11,0
oracle-vhba1.testlin2 20:78:00:C0:FF:0A:81:30 21:78:00:C0:FF:0A:81:30 9,8,7,6,5,4,3,0
2 records displayed
```

4. **Add LUN 9 of the second target to the mask "`oracle-mask`":**

```
add san lun-mask oracle-mask target 21:78:00:C0:FF:0A:81:30 lun 9
```

5. **Display the settings of the LUN Mask "`oracle-mask`":**

```
show san lun-mask oracle-mask
name                        descr             targets
-------------------------------------------------------------------
```

```
oracle-mask                              21:78:00:C0:FF:0A:81:30(0,9),
                                        20:70:00:C0:FF:0A:81:30(0,11)
1 record displayed
```

6. **Display the LUNs that vHBA "**`oracle-vhba1`**" is allowed to see:**

```
show vhba oracle-vhba1.testlin2 lun-mask
vhba                  name         descr          targets
-------------------------------------------------------------------
oracle-vhba1.testlin2 oracle-mask                 21:78:00:C0:FF:0A:81:30(0,9),
                                                  20:70:00:C0:FF:0A:81:30(0,11)
1 record displayed
```

However, before the rescan, the change will not take effect:

```
show vhba oracle-vhba1.testlin2 targets
vhba            name     wwnn                      wwpn                      lun-ids
-------------------------------------------------------------------------------------
oracle-vhba1.testlin2  20:70:00:C0:FF:0A:81:30  20:70:00:C0:FF:0A:81:30   11,0
oracle-vhba1.testlin2  20:78:00:C0:FF:0A:81:30  21:78:00:C0:FF:0A:81:30
                                                                  9,8,7,6,5,4,3,0
2 records displayed
```

7. **Issue the** `rescan` **command:**

```
set vhba oracle-vhba1.testlin2 rescan
```

8. **After rescan, display the settings of the LUN Mask "**`oracle-mask`**" on vHBA "**`oracle-vhba1`**":**

```
show vhba oracle-vhba1.testlin2 lun-mask
vhba                  name          descr          targets
-------------------------------------------------------------------------------
oracle-vhba1.testlin2  oracle-mask                 21:78:00:C0:FF:0A:81:30(0,9),
                                                   20:70:00:C0:FF:0A:81:30(0,11)
1 record displayed
```

9. **After rescan, display the LUNs that vHBA "**`oracle-vhba1`**" can see.**

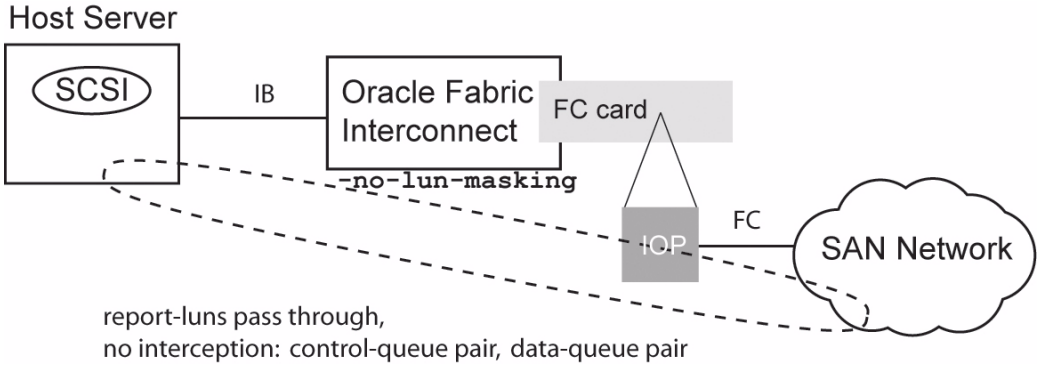
   Now the mask has taken effect:

```
show vhba oracle-vhba1.testlin2 targets
vhba                 name wwnn                      wwpn                      lun-ids
-------------------------------------------------------------------------------------
oracle-vhba1.testlin2  20:70:00:C0:FF:0A:81:30  20:70:00:C0:FF:0A:81:30   11,0
oracle-vhba1.testlin2  20:78:00:C0:FF:0A:81:30  21:78:00:C0:FF:0A:81:30   9,0
2 records displayed
```

Optional LUN Masking: No Report LUN Interception

When a host (Linux or Windows) issues a SCSI report LUNs, the chassis filters the response based on what is in the Oracle Fabric Interconnect database. If LUN masking changes in an array and a host issues a report LUNs, the new LUN will not be available to the host until a `set vhba rescan` command is run on the Oracle Fabric Interconnect. In some cases, this approach goes against customer expectations and breaks the existing model.

Use the `-no-lun-masking` feature to disable the LUN masking so that if you choose to do LUN masking on arrays, rescans on the Oracle Fabric Interconnect are not required. Specifically the `-no-lun-masking` feature disables the "report luns" interception and allows all new LUN/target information to pass through directly to SCSI. When SCSI issues the `report luns` command, the request will pass through the Oracle Fabric Interconnect's IOP and discover the disk array's new LUN/target information.



When a vHBA is created, LUN masking is enabled by default. An administrator must use `-no-lun-masking` to disable it. The `-no-lun-masking` flag can be specified only during the creation of a vHBA and cannot be changed throughout the lifetime of this vHBA. After specifying this flag while creating a vHBA, the CLI will also prevent you from assigning any LUN mask to this vHBA.

Note – No Report LUN Interception is the default when a vHBA is created.

Syntax

```
add vhba <name>.<server> [<wildcard>] <slot>/<port> -no-lun-masking
```

Example

To determine if LUN masking is enabled for a vHBA, see the "`l`" value under "`flags`". This filed means LUN masking is enabled:

```
add vhba bar.myserver 1/2
show vhba bar.myserver -detail
------------------------------------------------------------------
name              bar.myserver
state             up/resourceUnavailable
fabric-state      indeterminate
descr
if                1/2
if-state          down
wwnn              50:01:39:71:00:00:81:01
wwpn              50:01:39:70:00:00:81:01
luns-per-target   256
cmds-per-lun      8
map
lun-mask
flags              --l
local-id          0
```

Use `-no-lun-masking` to disable LUN masking on a newly added vHBA:

```
add vhba bar.myserver 1/1 -no-lun-masking
```

When LUN Masking is disabled, the CLI prevents you from assigning any LUN masking setting:

```
add vhba vhba888.titan 4/1 -no-lun-masking
set vhba vhba888.titan -lun-mask=oneida1
Commit failed: Please enable Lun Mask before setting Lun Mask (error 118)
```

▼ Change Port Topology from Fabric to Loop

XgOS supports changing a SAN topology or migrating from one topology to another—for example, changing the port topology from Fabric (f) to Loop (l). You can set the port topology type by using `set fc-port topology` command. Changing the port topology can be done in real-time and does not require an FC card reset.

To change the topology type from f to l, or l to f without resetting the card, follow this procedure:

1. **Display all vHBAs and note which ones are on the port where the topology will be changed.**

   For example, assume port 9/2 will have its topology changed:

```
show fc-port 9/2 vhbas
...
------------------------------------------------------------------
name           vh3.frack
state          up/up
fabric-state   up
if             9/2
if-state       up
wwnn           50:01:39:71:00:00:21:07
wwpn           50:01:39:70:00:00:21:07
map
lun-mask       overland202
local-id       2
------------------------------------------------------------------
name           vh3.frick
state          up/up
fabric-state   up
if             9/2
if-state       up
wwnn           50:01:39:71:00:00:21:05
wwpn           50:01:39:70:00:00:21:05
map
lun-mask       overland202
local-id       2
------------------------------------------------------------------
2 record displayed
```

2. **Delete all the vHBAs terminated on the port for which you will change the port topology.**

   For example:

```
remove vhba vh3.frick
remove vhba vhsan.brack-sanboot
```

3. **If you do not want to delete the vHBAs, you can do the following steps:**

   a. **Set the vHBAs on the port to "down" state**

   b. **Set the interface to "none"**

   c. **Make the port topology change**

   d. **Disconnect the fibre channel cable, then reconnect the fibre channel cable**

   e. **Set the interface on the vHBAs back to this port.**

4. **Disconnect the fibre channel cable that will be connected to the new topology.**

5. **Set the new port topology type.**

   For example, assume that port 9/2 will be changed from f-port to l-port:

```
set fc-port 9/2 -topology=l-port
```

6. **Reconnect the fibre channel cable to the port with the new topology.**

7. **Add the deleted vHBAs back to the port.**

   For example, to add vHBAs to port 9/2:

```
add vhba vh3.frick 9/2
add vhba vhsan.brack-sanboot 9/2
```

   For vNIC-to-vNIC Switching to be successful, the port's Access VLAN (sometimes called the native VLAN) must be a non-default value.

CHAPTER 9

VMware ESX Servers

This chapter describes configuring virtual I/O for VMware ESX in the following sections:

- "Introducing Virtual I/O for VMware ESX" on page 179
- "VMware ESX Support in XgOS" on page 180
- "ESX Utilities" on page 181
- "ESX Configuration" on page 182
- "Caveats" on page 188
- "Automatic Rescans in ESX" on page 189

Introducing Virtual I/O for VMware ESX

From the Oracle Fabric Interconnect's viewpoint, a VMware ESX server appears and works similar to a standard server. Simply add a server profile and a vNIC or vHBA. All the configuration for vSwitches and attaching virtual machines to network resources occurs within the VMware Infrastructure Client (provided by VMware as part of the ESX server package).

The following comes into play when configuring the system:

- Local ID—The identity of a vNIC on the ESX server. A local ID also applies to vHBAs but it's not as significant. The mapping of network interfaces (vNIC to vSwitch) has security implications whereas the direct-mapping order of vHBAs is still present but of lesser concern.
- Predefined vNICs—The local ID maps vNICs into 32 predefined vNIC names (vnic 1 through vnic 32) on the ESX server. Unlike on standard Linux servers, you cannot pick your own vNIC name. A Local ID allows you to specify which of those 32 pre installed vNICs you are going to use. Issue `ifconfig` after you

install the host drivers to see 32 vNICs not added or attached to anything. These are placeholders for when the interfaces are associated to Virtual Machine Networks.

- Predefined vHBAs—In the configuration section of VMware Infrastructure Client, a list of 12 virtual storage adaptors are pre installed as soon as you load the Oracle host drivers. A WWN appears next to the adaptors that are configured for the Oracle Fabric Interconnect.
- HA vNICs—High Availability (HA) vNIC support is handled through NIC Teaming. Use the VMware Infrastructure Client to configure a teamed pair of vNICs. These two network interfaces attach to the same vSwitch.
- ESX Server update—Do not enable automatic updates for your ESX Server systems. Automatic updates can download patches that are not certified and might be incompatible with your Oracle host drivers and I/O resources. Installing such updates can bring your servers down. Rectifying this situation can require reinstalling the servers.

VMware ESX Support in XgOS

The following text is additional information about the Oracle Fabric Interconnect's support for VMware:

- VMware VMs cannot be created or deleted through the XgOS CLI or GUI.
- VMware VM operational state cannot be managed through the XgOS CLI.
- VMware cannot be managed through the XgOS CLI and GUI.
- VMware ESX servers cannot be managed through the XgOS CLI or GUI.
- Xsigo virtual I/O (vNICs and vHBAs) is extended to virtual machines where they can be attached to individual VMs by using VMware management facilities (such as VMware Virtual Infrastructure Client). When attached to a virtual machine, Xsigo virtual I/O can be added, migrated, deleted, turned up and turned down through the XgOS CLI and GUI (through a plug-in to the Virtual Infrastructure Client).
- Xsigo virtual I/O appears in VMware ESX servers, but does not appear in individual virtual machines.

Syntax

Create a server profile:

```
add server-profile <profile-name> <server-name>@<f1-15-hostname>:<ib-port>
```

then add a vNIC or vHBA with a `local-id` value:

```
add vnic <vnic>.<profile-name> <slot>/<port> -local-id=<value>
add vhba <vhba>.<profile-name> <slot>/<port>
```

A `local-id` maps a vNIC into 32 predefined vNIC names (vnic1 through vnic32) on the ESX server. A local-id for a vHBA is rarely used. See "Introducing Virtual I/O for VMware ESX" on page 179.

ESX Utilities

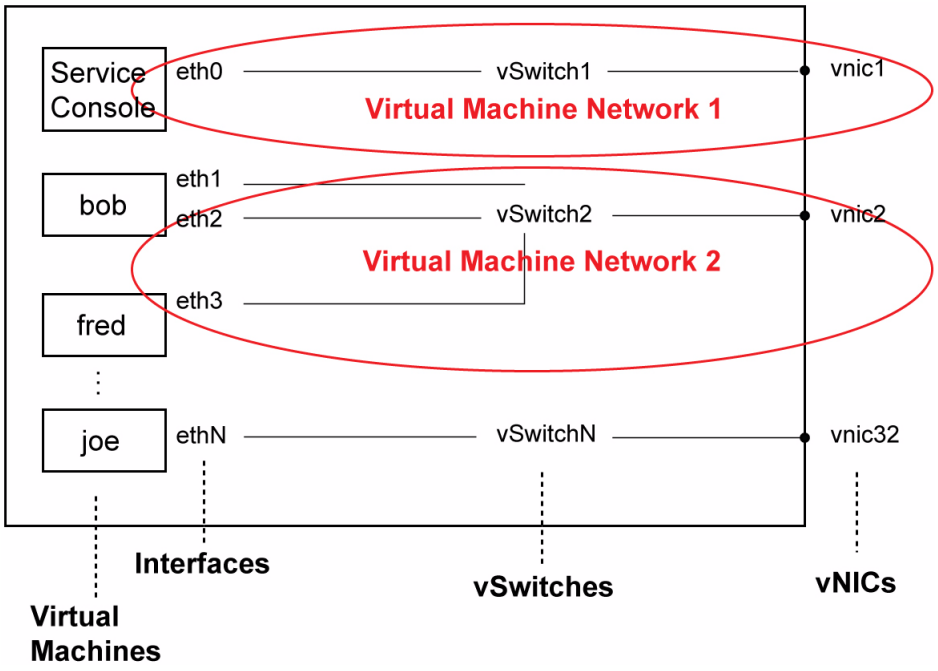
The following commands are useful when configuring virtual I/O under ESX:

- `esxcfg-xgmap` is a OVN-provided command that outputs a list of Xsigo vNIC and vHBA names mapped to their VMware names.
- `esxcfg-vswitch` is an ESX command that displays and controls VMware vSwitches.
- `esxcfg-vmhbadevs` is an ESX command that includes most of the ESX networking commands.
- `esxcfg-mpath` is an ESX command that controls multipathing in the virtual environment.
- `vmware-cmd` is an ESX command that performs registration, VM start, and VM stop from a bash shell.
- `xsigo-support` is a OVN-provided command that gathers logs and other Oracle information from the ESX server for submission to Oracle technical support.
- `vm-support` is a VMware command that gathers logs and other VMware information from the server for submission to technical support.

For more detailed information, see figure in "ESX Configuration" on page 182.

ESX Configuration

The ESX server in the following figure has four virtual machines (Service Console, bob, fred, joe). Each VM has Ethernet interfaces (eth0 ... 20500), a vSwitch, and belongs to a Virtual Machine Network. VNICs will appear as “vnic1”, “vnic2”,”vnic3”, and so on, up to a “vnic32”. You can have any number of vSwitches (vSwitchN), and any given vSwitch can associate with any number of vNICs.



▼ Enable vNIC Communication Between the ESX Server and the Oracle Fabric Interconnect

Use the following steps to enable vNIC communication between the ESX server and Oracle Fabric Interconnect:

1. **Install the InfiniBand RPM on the ESX server:**

```
rpm -ivh VMware-esx-commsrc-infiniband-release-3.8.0-1.09.60.rev401.i386.rpm
```

Linux ships with its own IB drivers, but the ESX server does not. This IB RPM file must be installed before the Xsigo ESX Commsrc file (next step).

2. **Install the Xsigo VMware host drivers on the ESX server:**

```
rpm -ivh VMware-esx-commsrc-xsigo-release-3.8.0-v99x3.8.0.i386.rpm
reboot
```

3. **On the Oracle Fabric Interconnect, create a vNIC to use with the ESX server:**

```
add server-profile myserver vmware@iowa:ServerPort23
add vnic myvinc.myserver 4/1 -local-id=4
```

If you do not specify a `local-id` when adding a vNIC, ESX will assign one for you.

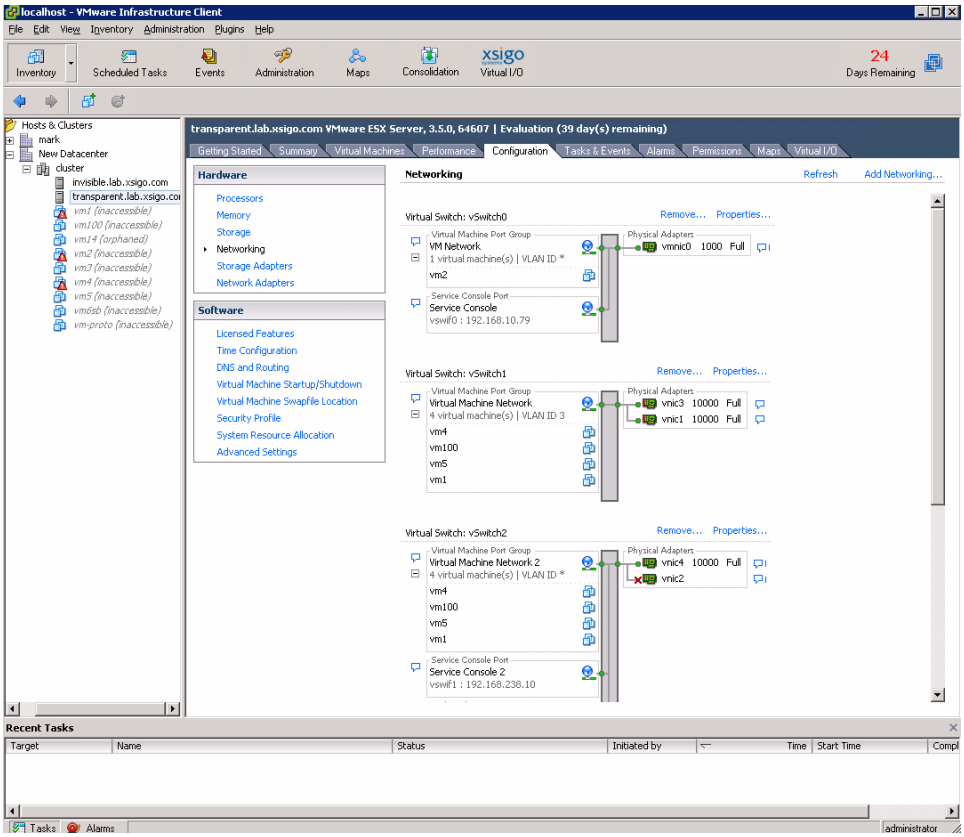
The vNIC's addressing is not added on the Oracle Fabric Interconnect side. VMware configures and manages the addressing.

Note – This release of XgOS has a limitation. You must add and attach a server profile first. If you add vNICs and vHBAs to a server profile before you attach it (physcon) to the ESX server, the server profile will not work properly. See "Caveats" on page 188 for more details.

---

4. **Create a Virtual Machine Network using the VMware Infrastructure Client.**

The network Ethernet name on the ESX server corresponds to the vNIC local-id configuration on the Oracle Fabric Interconnect. For example, local-id 1 corresponds to "`vnic1`." Local-id 2 is "`vnic2`" and so on.

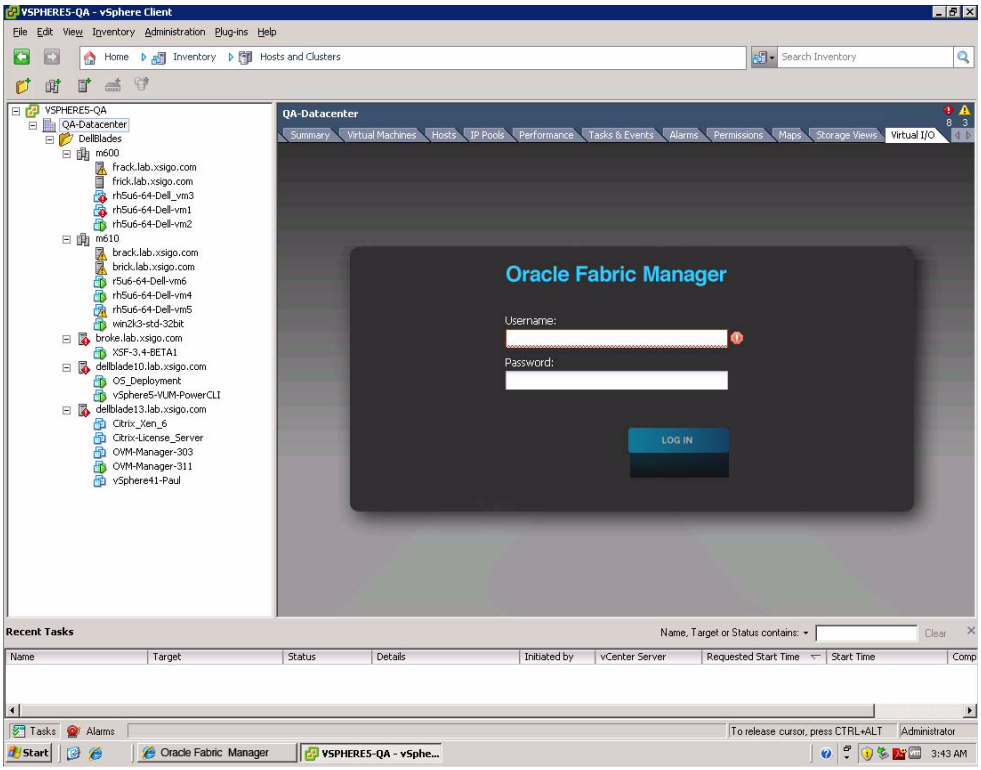


Oracle created a Fabric Manager VMware Extension that operates with VMware VirtualCenter. The extension runs the Oracle Fabric Manager web interface. It enables you to display and manage your virtual I/O as a plug-in service to a VMware Infrastructure Client connection to VMware VirtualCenter.

5. **To use the VMware extension, install the Xsigo ISO or zip file to VMware VirtualCenter:**

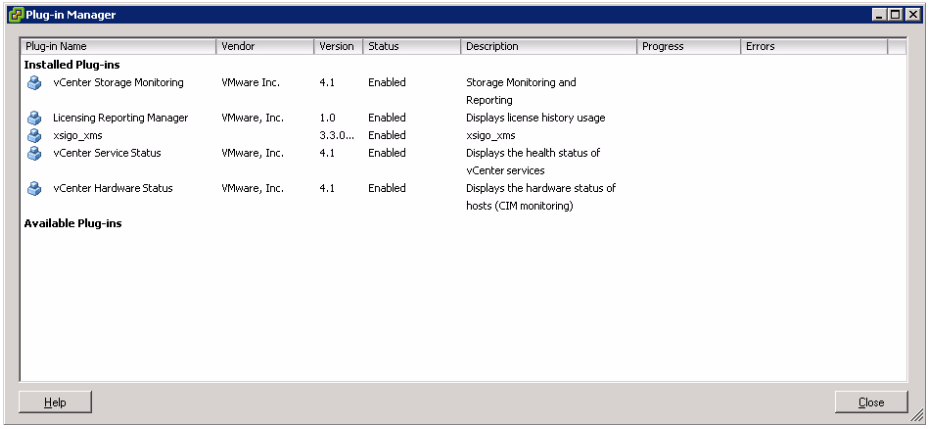
```
Fabric Manager-plugin4vc-3.8.0.iso
Fabric Manager-plugin4vc-3.8.0.zip
```

Once installed, the Xsigo Virtual I/O plug-in is displayed within the VMware Virtual Infrastructure Client as a tab.



6. **If the Virtual I/O tab is not displayed, click Plug-ins on the toolbar to verify the state of the Oracle Fabric Manager.**

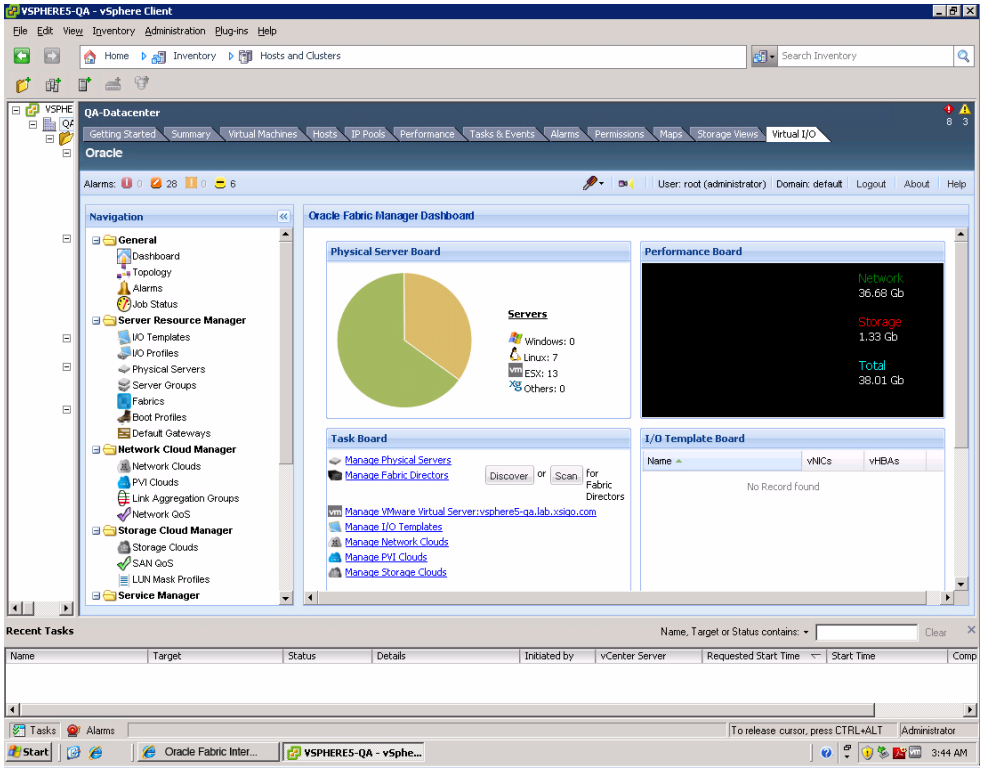
   This figure shows an example of the Plug In Manager with Oracle Fabric Manager enabled.


Plug-in Manager
Plug-in Name Vendor Version Status Description Progress Errors
Installed Plug-ins
vCenter Storage Monitoring VMware Inc. 4.1 Enabled Storage Monitoring and Reporting
Licensing Reporting Manager VMware, Inc. 1.0 Enabled Displays license history usage
xsigo_xms 3.3.0... Enabled xsigo_xms
vCenter Service Status VMware, Inc. 4.1 Enabled Displays the health status of vCenter services
vCenter Hardware Status VMware, Inc. 4.1 Enabled Displays the hardware status of hosts (CIM monitoring)
Available Plug-ins
Help
Close

If the Oracle Fabric Manager has not been integrated into Virtual Infrastructure Client, no Fabric Manager plug-in is displayed in the Plug-in Manager.

If the Oracle Fabric Manager has been integrated, but a problem exists, an Fabric Manager entry is displayed in the Plug-in Manager, but the Status field will show "Disabled."

After you log into Oracle Fabric Manager, the Dashboard is displayed as shown this figure. You can now use Oracle Fabric Manager for configuration and management of virtual I/O and its associated features.



▼ Monitor vNICs

1. **From the Oracle Fabric Interconnect, monitor the health of the vNICs:**

```
show vnic <vnic>.<server> -detail
```

All configuration can be done via the VMware Virtual Infrastructure Client. However on the ESX Server, there are many useful CLI commands available to you.

2. **To find the device mapping between the pre-installed virtual resources and the ones that are attached into the Oracle Fabric Interconnect:**

```
esxcfg-xgmap
vh0  -> vmhba32
vh1  -> vmhba34
vn10  -> vnic10
vn11  -> vnic11
vn12  -> vnic12
....
```

3. **Connect the vNIC to a vSwitch either through the ESX's GUI or through the** `esxcfg-vswitch` **command to uplink the vNIC and list it:**

```
esxcfg-vswitch -L vnic1 vSwitch1
esxcfg-vswitch -l
```

The `esxcfg-vswitch` command provides an interface for adding, removing, and modifying virtual switches and their settings. By default, there is a single virtual switch called "vSwitch0".

The `esxcfg-vmhbadevs` command provides information about the LUNs available on the ESX server. By default, the command will print a mapping of vmhbaX:X:X names to console /dev/ names:

```
esxcfg-vmhbadevs
vmhba0:0:0      /dev/sda
vmhba32:2:1     /dev/sdd
vmhba32:2:2     /dev/sde
vmhba32:2:3     /dev/sdf
vmhba32:2:4     /dev/sdg
...
```

Caveats

The following sections cover specific issues of which you must be aware when configuring virtual I/O resources for ESX servers.

Set Local ID for Resources on Down or Unattached Server Profiles

You must explicitly set the `local-id` on vNICs and vHBAs that are added to an unattached or administratively down server profile. `local-id` will be set automatically on resources that are added to an active server profile only.

Example:

```
add server-profile server1
add vnic vnic1.server1 1/1 -local-id=1
add vhba vmhba34.server1 1/1 -local-id=3
set server-profile server1 connect foo@iowa:ServerPort1
```

Resources added to down or unconnected server-profiles without the `local-id` set will remain in the `resourceUnavailable` state, and must be removed and re-added.

NIC Teaming and Load Balancing

If you are using NIC teaming on a vSwitch, be aware that only one load balancing policy is supported on the ESX server. The only supported load balancing policy on ESX server is "Route based on the originating virtual port ID," which is the default option. None of the other load balancing policies are supported.

Automatic Rescans in ESX

In ESX, discovery of new vHBA devices and changes to the FC fabric often require a rescan. Rescanning propagates fibre-channel information to the various components including storage driver, operating system, and management software. The OVN driver package includes a thin daemon called `xsigo-hotplug` which attempts to periodically propagate this information automatically.

You can enable, disable, or tune `xsigo-hotplug` by changing configuration settings in the following file in XgOS:

```
/etc/sysconfig/infiniband/mgmt-xsigo.ini
```

The default settings are to enable the daemon by default and to poll all the Xsigo vHBA device instances every 10 seconds.

The daemon first checks whether there are any storage configuration changes according to the schedule set in the file. Then, if there are changes, it issues a rescan request to ESX. You can also issue an immediate rescan of the adapters by issuing a rescan from within Virtual Infrastructure/VirtualCenter client through one of the Storage Adapters or Storage Configuration tabs.

Note – Rescans can take approximately one second per volume (disk or LUN). In large systems, this can delay other operations. Before changing the polling interval, consult Oracle technical support.

Potential Issues With Automatic Rescans

Storage vendors behavior varies, making automatic discovery of new disks and LUNs difficult. Some storage does not immediately issue an RSCN or like event. In order to discover new disks, you might need to initiate a rescan of the Xsigo vHBA from the Oracle Fabric Interconnect chassis by issuing the following command at a command prompt:

```
set vhba myvhba.esxserver rescan F1-15> set vhba * rescan
```

You can then press the “Rescan” button in the “Storage Adapters” configuration tab of the Virtual Infrastructure/VirtualCenter client.

Also, note that using the command line tool `esxcfg-rescan <vmhba>` does not propagate information to the VI/VC-Client datastore, but instead only updates the VMKernel and ConsoleOS. You must press the "Rescan" button in the "Storage Adapters" configuration tab before they will be visible in the GUI-client.

Note – One situation when you might need to request a rescan is when you remove or reconfigure a vHBA. See "Remove vHBAs Connected to VMware Virtual Machines" on page 160 for instructions about removing a vHBA in a VMware environment.

CHAPTER 10

Network QoS for vNICs

Oracle's network Quality of Service (QoS) provides administrators the ability to treat packets differently, based on the type of traffic. This chapter explains how to configure a QoS policy and apply it to virtual resources. It contains the following sections:

- "QoS Terminology" on page 191
- "Network QoS Services" on page 193
- "QoS Operations Overview" on page 193
- "QoS Feature Matrix" on page 195
- "QoS Default Sets" on page 195
- "QoS Custom Sets" on page 197
- "ACLs With QoS and Application QoS" on page 202
- "Disabling QoS on a vNIC" on page 205
- "Application QoS With Ingress 802.1p and IP Precedence Mapping" on page 206
- "DSCP Mapping on 10GbE Cards" on page 207

Network QoS profiles, like most objects in the Oracle Fabric Interconnect, have "Naming Conventions" on page 8.

QoS Terminology

Requirements can be expressed in terms of committed/peak information rate, committed/peak burst size, application flows, traffic direction, and network delay incurred by an I/O module. QoS ensures traffic differentiation during congestion periods. The behavior of one type of traffic should not affect the observable characteristics of another type of traffic. A policer restricts the amount of bandwidth to a set rate. All traffic transmitted or received above a defined threshold is dropped.

Note – The SAN QoS feature set uses vHBAs (not vNICs) and is different from network QoS. See "SAN QoS for vHBAs" on page 209.

Network QoS assigns the amount of bandwidth and burst size to a given vNIC. The burst size is the amount of buffering retained for when traffic arrives in bursts during congestion.

Bandwidth

Guaranteed bandwidth on vNICs is supported through the CIR and PIR values:

- CIR—Committed Information Rate. The amount of bandwidth guaranteed to the vNIC. The CIR is best effort. There is no rate restriction (imposed limit) over the bandwidth usage.
- PIR—Peak Information Rate. The amount of best effort bandwidth (not guaranteed) for the vNIC to consume as resources become available. By default, the PIR is the maximum-possible limit of the physical I/O card.

CIR and PIR are specified in Kilobits per second by default. Through software, you can change the units by using the abbreviations m, g, and k for Mbps, Gbps, and Kbps respectively.

When implementing Network QoS, due to traffic management overhead, to get accurate CIR (within 5% range), the sum of all CIRs on an Ethernet link must be less than 90% of the total link speed. For example CIR1=200 mbps, CIR2=600 mbps, and CIR3=100 mbps on a 1 Gbps link. Total link speeds can be either 1 Gbps on a 10-Port GE link, or 10 Gbps on the 10 GE link.

Burst Size

Guaranteed bandwidth during traffic bursts or network congestion is supported through CBS and PBS values:

- CBS—Committed Burst Size. The amount of data committed to be sent in one transaction.
- PBS—Peak Burst Size. The amount of best-effort data that can be sent in one transaction.

CBS and PBS are specified in bytes by default. through software, you can change the unit to Gbps and Mbps by using the abbreviations m, g, and k for Mbps, Gbps, and Kbps respectively.

CBS and PBS values can also be automatically calculated to linear values based on the CIR and PIR values that you specify. This feature is supported for custom default sets only. For more information about automatic calculation, see "Automatic Calculation" on page 199.

Network QoS Services

XgOS provides Network QoS Policing services. Policing enforces rate limits on traffic to a designated rate.

There are two ways to configure network QoS:

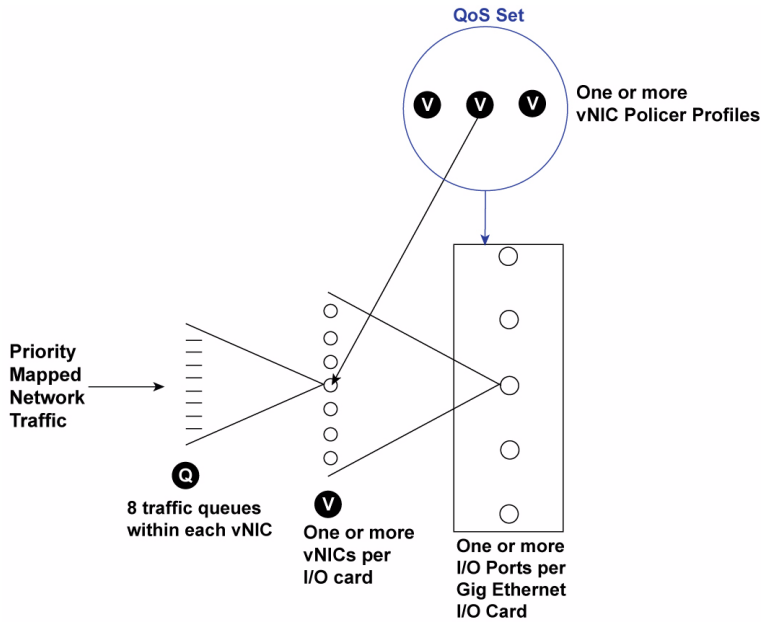
Default Sets—Use the default set profiles (recommended). See "QoS Default Sets" on page 195.

Custom Sets—Create your own custom set. See "QoS Custom Sets" on page 197.

Both approaches follow the same "QoS Operations Overview" on page 193.

QoS Operations Overview

In OVN's implementation, a QoS set is a consolidated group of policer profiles. The following figure shows the OVN QoS model.



Each vNIC has eight traffic queues. Network traffic can enter on any of the queues, but the QoS Profiles are applied to vNIC traffic on all queues. If QoS parameters have been assigned to the vNIC, the associated vNIC Profile is applied to the traffic. As a result, the information rate and burst size parameters are applied to the traffic. Because network QoS Policer profiles are configured, any traffic that is out of the range created by the CIR, PIR, CBS, and PBS parameters is dropped.

Also, notice in this example that the QoS set is applied to the actual I/O card, and the vNIC QoS profiles are assigned to individual vNICs. Each I/O card can be set with only one main policy, but that policy can contain many subset policies (for example, /1, /2, /3 and so on for the main policy `foo`). The vNIC QoS profiles (not the card QoS sets) are what actually police the traffic.

QoS Feature Matrix

The following table describes the network QoS features supported Oracle Fabric Interconnect's Gigabit Ethernet I/O modules.

Feature	10-Port Gigabit Ethernet Module	10GbE Module (1 port)
Ingress and egress policing	Yes	Yes
802.1p mapping*	Yes	Yes
IP TOS mapping	Yes	Yes
DSCP mapping	Yes	Yes
Assigning sets to a card	Yes	Yes

* See the "`mark`" option in "Setting Actions" on page 214.

Note – 802.1p priority mapping is supported, but all queues currently have the same priority. Also, for the 10-Port Gigabit Ethernet module, do not assign more than 16 vNICs per port. Assigning more than 16 vNICs per port causes multiple vNICs to be assigned to the same traffic queue, which results in non-deterministic application of the Network QoS Policer.

QoS Default Sets

XgOS provides a default set of QoS profiles as a configuration convenience to you.

When configuring default QoS Set profiles, the general QoS configuration approach is as follows:

1. Define a QoS default set
2. Specify a profile within the set
3. Associate the profile to a vNIC and specify a traffic direction (ingress or egress).

Note – If you have multiple 10 GE or 10-Port GE cards and want to deploy the same QoS policy to all the cards irrespective of vNIC movement, then use the same tested QoS set for all the cards. Each time a vNIC moves across I/O cards, it will be treated with the same QoS behavior. Applying different QoS sets to different cards does not guarantee QoS for vNIC movement.

4. Issue the following commands to display the default profile names and settings for the policer.

   Sample output (see commentary after screen shots):

```
show qos network policer
name               level  descr      cir          pir          cbs        pbs
-------------------------------------------------------------------------------
default/100m_1g    global 100m_1g    100Mbps      1Gbps        17.8814MB 35.7628MB
default/100m_250m global 100m_250m 100Mbps      250Mbps      17.8814MB 35.7628MB
default/10g_10g    global 10g_10g    9.9297Gbps   9.9297Gbps 1.73395GB 1.73395GB
default/10m_100m   global 10m_100m   10Mbps       100Mbps      1.78814MB 3.57628MB
default/10m_1g     global 10m_1g     10Mbps       1Gbps        1.78814MB 3.57628MB
default/10m_50m    global 10m_50m    10Mbps       50Mbps       1.78814MB 3.57628MB
default/1g_10g     global 1g_10g     1Gbps        9.9297Gbps 178.814MB 357.628MB
default/1m_10m     global 1m_10m     1Mbps        10Mbps       182.617KB 365.234KB
default/250m_500m global 250m_500m 250Mbps      500Mbps      44.7035MB 89.407MB
default/2g_10g     global 2g_10g     2Gbps        9.9297Gbps 357.628MB 715.256MB
default/3g_10g     global 3g_10g     3.00293Gbps 9.9297Gbps 536.965MB 1.04876GB
default/4g_10g     global 4g_10g     4Gbps        9.9297Gbps 715.256MB 1.39698GB
default/500m_750m global 500m_750m 500Mbps      750Mbps      89.407MB  178.814MB
default/50m_100m   global 50m_100m   50Mbps       100Mbps      8.9407MB  17.8814MB
default/5g_10g     global 5g_10g     5.00122Gbps 9.9297Gbps 894.287MB 1.74665GB
default/64k_1m     global 64k_1m     64Kbps       1Mbps        11.7188KB 23.4375KB
default/6g_10g     global 6g_10g     6.00587Gbps 9.9297Gbps 1.04876GB 2.09752GB
default/750m_1g    global 750m_1g    750Mbps      1Gbps        134.11MB  268.221MB
default/7g_10g     global 7g_10g     7.00171Gbps 9.9297Gbps 1.22266GB 2.44532GB
default/8g_10g     global 8g_10g     8Gbps        9.9297Gbps 1.39698GB 2.79397GB
default/9g_10g     global 9g_10g     9.0022Gbps   9.9297Gbps 1.57199GB 3.14398GB
```

Note the default profile names, bandwidth sizes, and levels. For convenient configuration, simply choose a default profile (i.e., default/7g_10g), specify a traffic direction (ingress or egress), and assign it to a vNIC. See "Example" on page 197.

You can use these default profiles (recommended) or create your own custom profiles (see "QoS Custom Sets" on page 197). The system also allows users to modify a default set and its behavior, then apply the new values to one or more I/O cards.

Syntax

```
set vnic <name> {ingress-qos|egress-qos} -policer=default/<name>
    [enable|disable]
show vnic
show qos network policer [*|<set/name>]
```

A profile itself has no direction (ingress or egress). You must explicitly apply two profiles (one for each direction) to each object. No QoS is available for a traffic direction that is not specified.

The system allows you to `disable` QoS on a specific vNIC. The default is `enable`.

Example

Choose a default profile (`default/2g_10g`), specify a traffic direction (`ingress-qos, egress-qos`), and assign it to a vNIC (`t1.foo`) in both the ingress and egress direction:

```
set vnic t1.foo ingress-qos -policer=default/2g_10g enable
set vnic t1.foo egress-qos -policer=default/2g_10g enable
```

In this example, a policer was applied to the vNIC. During periods of network congestion, 2G is guaranteed (CIR). During periods of no network congestion, maximum bandwidth is allowed.

To define your own QoS custom set (not use `default/<name>`), see the next sections.

QoS Custom Sets

XgOS enables you to create your own QoS custom set (profile) and apply it to vNICs. By default, a new custom set is empty.

A custom set must first be applied to an Ethernet I/O card before being applied to a vNIC. You can use the `set ethernet-card` command with the `qos` qualifier to apply the custom set to an I?O card. After being applied to an I/O card and vNIC, a set becomes available and can police traffic.

When configuring custom QoS sets, the general QoS configuration approach is as follows:

1. Create a custom QoS set.
2. Specify a profile within the set. Repeat this step as needed to define all profiles in the custom QoS set.

   As an option, you can also specify one or more profiles in the QoS set after it has been assigned to the I/O card.
3. Assign the custom QoS set to an I/O card.
4. Associate the profile to a vNIC and specify a traffic direction (ingress or egress).

Note – If you have multiple 10 GE or 10-Port GE cards and want to deploy the same QoS policy to all the cards irrespective of vNIC movement, then use the same tested QoS set for all the cards. Each time a vNIC moves across I/O cards, it will be treated with the same QoS behavior. Applying different QoS sets to different cards does not guarantee QoS for vNIC movement.

Use `add` and `set` commands to control the policer's behavior for vNICs. You can configure a QoS policer in the ingress direction, egress direction, or both. The configurations can be asymmetrical over the same vNIC. For example, the ingress policer can be set to 100 Mbps while the egress direction is 200 Mbps. After a policer has been added, you can change its profile values dynamically (on-the-fly) by issuing `set` commands.

Syntax

```
add qos network policer <set/name> [-cbs=<value>] [-pbs=<value>] -cir=<value>
    -pir=<value>
set ethernet-card <slot> qos -set=<name>|default|none
set vnic <name> {ingress-qos|egress-qos} -policer=<set>/<subset> [-enable]
    [-disable]
show vnic <name> qos
remove qos network policer <set/name>
```

where a policy name is in the form of `<set>/<subset>`.

Note – If you need to remove the QoS set association from an I/O card, use the command `set ethernet-card <slot> qos -set=none`.

Automatic Calculation

Automatic calculation ensures that the optimal linear-function settings are configured. XgOS supports the automatic calculation of CBS and PBS. When you specify the CIR and PIR as the first and second QoS parameters (but do not specify CBS and PBS), XgOS automatically calculates the equivalent CBS and PBS values.

To allow automatic calculation for the CBS and PBS parameters, you can either enter only the CIR and PIR parameters as the first two values in the command (as shown in the following example), or you can set the CBS and PBS parameters to zero (0). For example, `-cbs=0` and `-pbs=0` achieves automatic calculation. Automatic calculation applies to CBS and PBS arguments only and only if you specify the CIR as the first qualifier and/or PIR as the second qualifier.

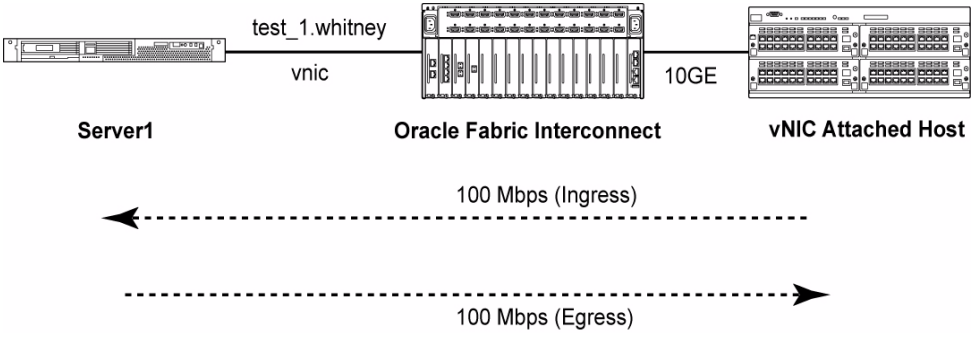
Example:

```
add qos network policer aa/bb 10m 10m
show qos network policer aa/bb
name     level     descr    cir       pir       cbs          pbs
-------------------------------------------------------------------
aa/bb    global           10Mbps    10Mbps    1.78814MB    1.78814MB
1 record displayed
```

Note – In most cases, Oracle recommends you do not modify the CBS or PBS. Use the automatically calculated defaults by specifying only the CIR and PIR.

Example: vNIC Custom Policer for a 10GbE Card

The following figure shows an example topology of a policer in a 10 Gbps network.



In this example, Server1 attaches to an Oracle Fabric Interconnect over a vNIC. The Oracle Fabric Interconnect is fitted with one 10 GE I/O card in slot 4 that connects to a vNIC attached host. The Oracle Fabric Interconnect sends traffic to Server1 over a vNIC named "test_1.whitney". The QoS policer restricts the amount of ingress traffic (from network to server) arriving on Server1 to 100 Mbps. The egress traffic (from server to network) is also policed to 100 Mbps.

▼ Create a Policer for vNIC

The following steps were taken to create a policer for one vNIC. Use the same approach for multiple vNICs:

1. **Create a named policer policy:**

```
add qos network policer foo/100m_100m 100m 100m
```

   In this example, the name of the set (policer policy) is "foo" and the CIR and PIR are 100 Megabits per second. (Notice that you do not need to enter any qualifier for CIR and PIR.) The "/100m_100m" is the name of the subset policy (profile) within the policy called "foo". It is a good practice to name your policer policies after the conditions that they enforce on traffic. To differentiate your configurations, the system enables you to assign different vNICs to different subset policies.

   Notice that automatic calculation is used to determine the CBS and PBS values for this example. For more information about automatic calculation, see "Automatic Calculation" on page 199.

2. **Enable the QoS set and assign it to the appropriate I/O card ("4" in this example):**

```
set ethernet-card 4 qos -set=foo
```

3. **On a vNIC, enable policing for the ingress direction (network to server):**

```
set vnic test_1.whitney ingress-qos -policer=foo/100m_100m
```

Note – You can use the `-policer=none` option to remove the association of a QoS profile and vNIC.

---

4. **On the same vNIC, enable policing in the egress direction (server to network):**

```
set vnic test_1.whitney egress-qos -policer=foo/2
```

A profile itself has no direction. You must explicitly apply two profiles (one for each direction) to each object. QoS is available for a traffic direction only if the direction is specified.

5. **Verify the policer policy was assigned to the vNIC.**

The "policer" field indicates which policer policy was assigned to the vNIC. The "enable" field indicates whether QoS is enabled on the vNIC.

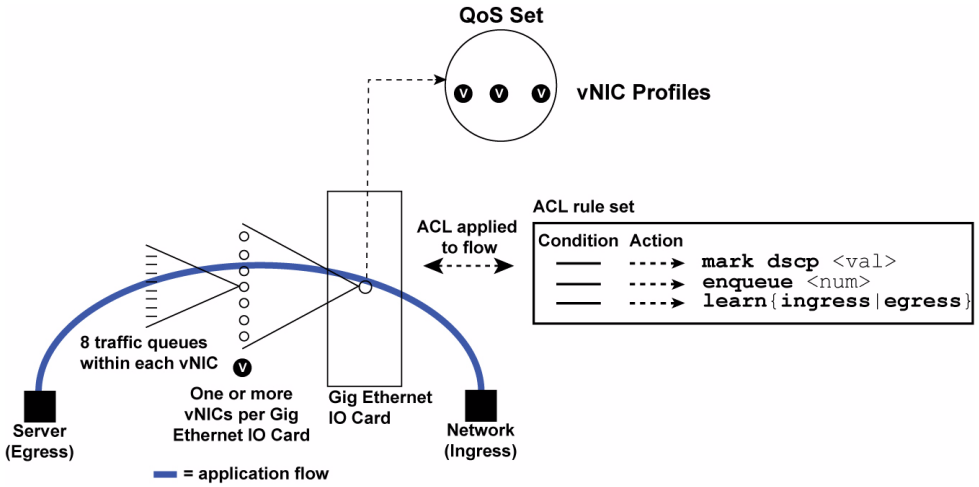
```
show -list vnic test_1.whitney qos
----------------------------------------------------------------------
name       test_1.whitney
direction  ingress
descr
policer    foo/2
enabled    yes
----------------------------------------------------------------------
name       test_1.whitney
direction  egress
descr
policer    foo/2
enable     yes
----------------------------------------------------------------------
2 records displayed
```

6. **Display the information rate and burst-size values applied to the policy:**

```
show -list qos network policer foo/2
----------------------------------------------------------------------
name   foo/2
level  global
descr
cir    100Mbps
pir    100Mbps
cbs    17.8814MB
pbs    17.8814MB
----------------------------------------------------------------------
1 record displayed
```

ACLs With QoS and Application QoS

ACL rule configurations can be used with QoS. Specify an action for each matched condition. A `condition` identifies the application flow to be chosen. An `action` specifies what to do with that flow. The following figure shows an example of an ACL with a QoS set.



From an ingress viewpoint traffic flows from the network, into a port, into a vNIC, into 1 of 8 queues, and onto a server. Each of the packets are evaluated against the defined ACL rules. Similarly, egress traffic (from server to network) is evaluated against the defined ACL conditions.

After you create ACL rules, apply the ACL rule set for a specific I/O card. Consider the following action use cases (see "Setting Actions" on page 214 for more details):

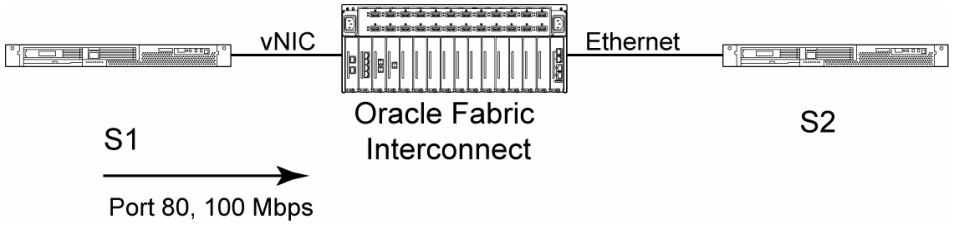
- Marking each packet in the flow with a DSCP value (`mark dscp <val>`).
- Placing matched packets into a specific queue number (`enqueue <num>`).
- Counting packets and collecting statistics for a flow that satisfies a condition (`learn ingress|egress`)

The 10GbE cards support application QoS, where specific traffic flows can be sent to different queues. Each vNIC supports 8-prioritized queues (0 to 7). Through software, you can control how those queues are used, such as setting QoS preferential treatment (bandwidth limiting) features for each queue. Specific packets can be sent into different queues. By default, all traffic flows map to queue 0.

Example: ACL-Based Policer for 10GbE I/O Cards

An ACL-based policer sets up an ACL that matches a particular flow, then polices that flow using QoS. For example, you can police communication between two IP endpoints down to a specific rate. Or, you can police based on traffic type port number (i.e., HTTP 80). ACL-based policers are supported on the 10 GE and 10-Port GE modules only.

The following figure shows an example of limiting egress traffic. In this example, server 1 (S1) is vNIC attached to the Oracle Fabric Interconnect. Server 2 (S2) is Ethernet attached. The following configuration restricts (limits) all HTTP traffic headed in the egress direction (server to network) to 100 Mbps. All traffic that is non HTTP traffic (no ACL match) gets max bandwidth.



Note – Unlike a standard policer configuration (see "Example: vNIC Custom Policer for a 10GbE Card" on page 199), ACL-based policing does not require QoS to be manually assigned to a vNIC.

▼ Create ACL-Based Policer

The following example creates an ACL-based policer matching any HTTP traffic, then rate limits that traffic down to 100 Mbps.

1. **Create a named QoS policer to limit traffic to 100 Mbps:**

```
add qos network policer test/100mhttp -cbs=100m -pir=100m
```

2. **Enable the QoS set and assign it to the appropriate I/O card number ("1" in this example):**

```
set ethernet-card 1 qos -set=test
```

3. **Create an ACL and assign it a name:**

```
add acl web100m
Warning: ACLs are not autocommitted.  You will need to enter
'commit' when the ACL is complete
```

No auto commits exist for ACLs. You must issue `commit` (see Step 5) after the ACL is defined completely.

4. **Define the ACL condition and action.**

The ACL names and rule numbers must match. All matched port 80 traffic in the egress direction will be restricted down to 100 Mbps by the QoS policer (test/100mhttp) configured in the earlier step:

```
set acl web100m rule 1 condition dest port exactly 80
set acl web100m rule 1 action police test/100mhttp
```

5. **Issue the commit after you are finished creating the ACL, setting the action, and setting the condition:**

```
commit
Are you sure you want to commit these changes (y/n)?y
```

6. **Assign the ACL to the I/O card:**

```
set ethernet-card 1 acl -set=web100m
```

7. **Inspect the applied ACL settings.**

If the destination port matches 80, the traffic is allowed to pass through but it will be policed based on the policy test/100mhttp:

```
show acl
name     rule  rank  descr  conditions            action
-------------------------------------------------------------------------
web100m  1     0   dest port exactly 80  allow, forget, police=test/100mhttp
1 record displayed
```

8. **Inspect the applied I/O card settings.**

The “a” in the “enables” row means an ACL is assigned to the I/O card. A “q” means a QoS policy is assigned to the card:

```
show iocard 1
---------------------------------------
slot     1
state    up/up
```

```
descr
type      nwEthernet1Port10GbCard
vnics     1
acl       web100m
enables   qa
-------------------------------------
1 record displayed
```

Disabling QoS on a vNIC

XgOS allows you to disable QoS for either ingress or egress traffic on a per vNIC basis. You can disable network QoS in different ways:

- Naming the Policer. If you disable QoS by naming a specific Policer, QoS is no longer active but the Policer remains attached to the vNIC. As a result, you can re-enable the Policer on the vNIC without having to bind the Policer to the vNIC again.
- Using the keyword `none`. If you disable QoS by setting the Policer to `none`, the Policer is no longer active, and it is removed from the vNIC. As a result, if you want to re-enable the Policer you will need to specify a QoS Policer for the vNIC as well as enable it. You cannot simply change the state to "enable" because there is no Policer to re-enable on the vNIC.

Note – Default network QoS Policers can be disabled as well as custom QoS Policers.

Syntax

```
set vnic <name> ingress-qos <policer-name>|none|* {disable|enable}
set vnic <name> egress-qos <policer-name>|none|* {disable|enable}
```

Examples

To disable the default 2 Gig policer for ingress traffic on a vNIC named "foo":

```
set vnic foo.bar ingress-qos -policer=default/2g_10g disable
```

By using this example, the default Policer is disabled, but remains bound to the vNIC. QoS is disabled for ingress traffic only, so egress traffic is not affected.

To disable the custom policer named “qostest/200” for egress traffic on a vNIC named “foo”:

```
set vnic foo.bar egress-qos -policer=qostest/200 disable
```

By using this example, the custom Policer is disabled, but remains bound to the vNIC. QoS is disabled for egress traffic only, so ingress traffic is not affected.

As an alternative, to disable the custom policer named “qostest/200” for egress traffic on a vNIC named “foo”:

```
set vnic foo.bar egress-qos -policer=none disable
```

By using this example, the custom Policer is disabled and removed from the vNIC. QoS is disabled for egress traffic, so ingress traffic is not affected. To re-enable QoS after using the keyword `none`, you must specify a Policer in the `-policer` option plus set the state to “enable.” For example:

```
set vnic foo.bar egress-qos -policer=qostest/200 enable
```

Application QoS With Ingress 802.1p and IP Precedence Mapping

Ingress traffic can be mapped into specific queues by changing the bits in packets to send the packets to one of eight queues supported per vNIC. The following table defines the mapping of 802.1p and IP precedence/TOS values to queues on 10GigE cards. The queue numbers in the table are relative to vNICs.

802.1p user priority	IP Precedence/TOS	Queue Number
Network Control, 7	Control, 7	7
Voice, 6	6	6
Video, 5	5	5
Control load, 4	4	4
Excellent Effort, 3	3	3

802.1p user priority	IP Precedence/TOS	Queue Number
Best Effort, 2	2	2
Spare, 1	1	1
Background, 0	Normal, 0	0

See the ACL `mark` option in "Setting Actions" on page 214.

Note – 802.1p and IP Precedence mapping is supported, but all queues currently have the same priority. The Oracle Fabric Interconnect uses a weighted fair queue (WFQ) algorithm to determine packet priorities.

DSCP Mapping on 10GbE Cards

DiffServ (RFC 2474) redefines the TOS byte by taking the top 6 bits of the top byte as a Differentiated Services Code Point (DSCP). Hardware sets up a DSCP mapping table to map DSCP values to queues. All undefined values are mapped to the queue corresponding to the DF.

DSCP Mapping is supported on all versions of GE card. The following table shows the supported DSCP services, values, and the vNIC queue that maps to the service.

DSCP Name	Value (Binary)	Queue Number
EF	101110	7
AF43	100110	6
AF42	100100	6
AF41	100010	6
AF33	011110	5
AF32	011100	4
AF31	011010	3
AF23	010110	2
AF22	010100	2
AF21	010010	2
AF13	001110	1

DSCP Name	Value (Binary)	Queue Number
AF12	001100	1
AF11	001010	1
DF (Other)	000000	0

CHAPTER 11

SAN QoS for vHBAs

Oracle's vHBAs support QoS where the bandwidth is rate limited with shaping (not dropped). There are no queues or policers associated with FC traffic—only shapers. This chapter presents the SAN QoS features and how to configure them in the following sections:

- "SAN QoS Features" on page 209
- "Commands" on page 210

Note – See "Virtual Host Bus Adapters (vHBAs)" on page 133 for information about non QoS vHBA features.

SAN QoS profiles, like most objects in the Oracle Fabric Interconnect, have "Naming Conventions" on page 8.

SAN QoS Features

Supported features:

- Shaping
- CIR and CBS control
- PIR and PBS control
- vHBA service only

Not supported:

- Policing
- Default set profiles (i.e., `default/<name>`). There is no default configuration created for SAN QoS.
- Custom set profiles: I/O port, vNIC, queue

- Using ACLs with SAN QoS
- Automatic calculation on SAN QoS for CBS and PBS
- Ingress vs egress direction control

Commands

QoS shaping services can be applied to FC cards by using `add qos san` and `set qos san`.

Syntax

```
add qos san <policy-name> [-noconfirm]
set qos san <policy-name> [-descr="text"] [-cir=<value>] [-pir=<value>]
    [-cbs=<value>] [-pbs=<value>]
set vhba <vhba-name> -qos=<name>
show qos san [<policy-name>]
```

Parameter Description

Parameter	Description
`add qos san <policy-name>`	Creates a named QoS shaping policy.
`set qos san <policy-name> -cir=<value> -pir=<value> -cbs=<value> -pbs=<value>`	Configures any number of shaping-policy values. The values are optional. You can configure a SAN shaping service without setting any values and default SAN shaping-policy values are applied. If you specify values, by default CIR and PIR are Mbps and CBS and PBS are MB.
`set vhba <vhba-name> qos <policy-name>`	Binds the policy to a vHBA.
`show qos san <policy-name>`	Displays all configured SAN shaping services or the SAN shaping service that is to a specific vHBA.

▼ Create vHBA With Shaping

Take the following steps to create a SAN QoS shaping policy and apply it to a vHBA:

1. **Create a named QoS shaping policy. The policy name is "test" in this example:**

```
add qos san test
```

2. **Configure the shaping-policy values. SAN QoS only limits bandwidth (no drops):**

```
set qos san test ?
Possible completions:
  [Optional qualifiers]
    -cbs    Committed burst size
    -cir    Committed information rate (optional K,M,G suffix)
    -descr  Description
    -pbs    Peak burst size
    -pir    Peak information rate (optional K,M,G suffix)
Repeat '?' for detailed help.
set qos san test -cir=250 -pir=500 -cbs=15 -pbs=250
```

3. **Bind the policy to a vHBA.**

   Whichever maximum bandwidth you defined will be applied to this vHBA. The vHBA's traffic will never exceed the defined policy values:

```
set vhba vhha1.finance -qos=test
```

4. **Verify the QoS shaping service is bound to the vHBA:**

```
show vhba vhha1.finance qos
-------------------------------------------
vhba   vhha1.finance
name   test
descr
cir    250Kbps
pir    500Kbps
cbs    15
pbs    250
-------------------------------------------
1 record displayed
```

CHAPTER 12

Access Control Lists

Access control lists (ACLs) classify packets. The classification result can be applied to quality-of-service application flows (mark, police) or to network-access control (deny, allow).

There are many use cases for ACLs. Consider the following examples:

- Prioritizing outbound traffic by marking fields in the IP header, thereby enabling upstream routers to handle this marked (set) traffic in a specific way. For example, any RTP VoIP traffic within a certain port range could have its IP TOS bit set to a value of 5. Any packet that satisfies these conditions will have its IP header field set by the I/O card.
- Intentionally dropping packets when a denial-of-service (DoS) attack is detected. All traffic must be blocked from specific IP or MAC addresses.

ACLs, like most objects in the Oracle Fabric Interconnect, have "Naming Conventions" on page 8.

This chapter explains how to configure ACLs for application to your network traffic. It contains the following sections:

- "Setting Actions" on page 214
- "Setting Conditions" on page 216
- "Displaying ACLs and Rules" on page 218
- "Removing ACLs" on page 219
- "Example: Denying Egress Traffic" on page 220

Setting Actions

You specify an action to be taken whenever a packet matches the specified condition. For each action except police and enqueue, you also specify a traffic direction: ingress, egress or both.

Syntax

```
set acl <set-name> rule <num> action <def> [-rank=<number>]
```

where <def> can be any of the following:

```
allow {both|egress|ingress}
deny {both|egress|ingress}
enqueue <num>
learn {both|egress|ingress}
mark {disable|dot1p <val>|dscp <val>|iptos <val>} {both|egress|ingress}
nolearn {both|egress|ingress}
police {*|<set/name>|none}
```

The default is `allow both`.

Parameter Description

Parameter	Description
`rule <num>`	The ID number for this rule.
`-rank=<number>`	A specific rank for the evaluation order of this rule. If you do not specify a rank, the Fabric Interconnect assigns a default rank based on the size (in bits) of the information in the condition definition. Thus, if all rules in a set are defined according to different types of information, the default ranks are unambiguous and you do not need to assign a specific rank to your rules. For example, if Rule 1 has a condition based on a source IP address while Rule 2 has a condition based on both destination IP address and destination port, Rule 2 will always be evaluated before Rule 1. If, however, your condition definitions include the same amount of information, the order of evaluation will be unpredictable. For example, if Rule 3 has a condition based on a source IP address while Rule 4 has a condition based on a destination IP address, evaluation of those rules can occur in either order. A packet that satisfies both conditions might have Rule 4 applied to it sometimes and Rule 3 applied to it other times. If this behavior is unacceptable, or if you need the order to be different from that resulting from the default rank assignment, you must provide a specific rank. To provide a specific rank, use the `-rank` modifier and provide a number. Ranks begin with zero (0). Lower ranking rules are evaluated before higher ranking rules.
`enqueue <num>`	Each vNIC uses only one queue by default (queue 0). If the condition matches, the system puts the packet into this queue number (from 0 to 7). Thereafter, a policy (i.e., a shaper) can be applied to the queue.
`learn`	The system starts counting the number of packets that matched the condition. If a LAG exists and you create an ACL rule with the learn action, flows that terminated on the LAG can have incorrect counters or not appear at all.
`mark`	The result of an ACL classification rule can specify marking a packet. This option applies priority marking to the packet using a supported marking algorithm: • 802.1p marking • IP precedence marking • DSCP marking, specify a single even number or a range of even numbers Only one of three marking mechanisms can be specified at a time. Setting one of them negates the other two. When the queue number (offsets 0 - 7) is specified, the marked packet is placed on the specified queue. See "Application QoS With Ingress 802.1p and IP Precedence Mapping" on page 206.
`nolearn`	The system does not count the number of packets that matched the condition.
`police`	Applies a QoS policer to the matched packet. The bandwidth can be limited to a specific level.

Example

```
set acl foo rule 3 action learn ingress
```

Setting Conditions

An ACL condition is a match-test rule to perform on a packet. A condition defines rules for fields the system checks during packet processing. Operators are available to match strings in those fields that follow a specific pattern.

Rule conditions, and rules themselves, can be modified and reassigned on the fly. If an ACL is created and bound to an I/O module, you can change the ACL or any of its component rules without removing the ACL or turning down the I/O module. Setting or redefining conditions for an ACL rule occurs through the `set acl` command.

Syntax

```
set acl <set-name> rule <num> condition <def> [-rank=<number>]
```

A `condition <def>` encompasses the following general form:

`<field-name><operator><value>`

where any of the following are supported:

```
dest {ipaddr<oper><val> mask<value>|mac<oper><val>
    mask <value>|port <oper><val>}
src {ipaddr<oper><val> mask<value>|mac<oper><val> mask<value>|port <oper><val>}
dot1p <oper> <number-or-range>
dscp <oper> <number-or-range>
protocol {icmp|igmp|<number>|tcp|udp}
tos <oper> <number-or-range>
vlan <oper> <number-or-range>
```

Operators

Operators match strings following a specific pattern. Use an operator in the following table to define how a field should be checked, where `<oper>` can be any of the following.

Operator	Description
`<`	Less than. Value of the field is less than the specified value
`<>`	Not equal to. Value of this field is not equal to (i.e., anything other than) the specified value.
`=`	Equal to (including masks if appropriate). Value of the field is equal to a single specified value (no wildcard)
`>`	Greater than. Value of the field is less than the specified value
`any`	A wildcard. Value of the field matches anything specified in the field.
`exactly`	Exactly equal (but not mask values). Value of the field is exactly what is specified in the field.
`in`	In a range. Value of the field matches if it falls within a range specified.

Support

The following support applies:

- For IP conditions, all operators are supported.
- For MAC conditions, the only operators supported are equal to (=) and any.
- For Port dot1p, DSCP, ToS, and VLAN conditions, all operators are supported except equal to (=)
- For Protocol conditions, the operators are not supported—only the choice list.

Example

```
set acl test rule 1 condition dest ipaddr = 10.1.1.1 mask 255.255.255.255
show -list acl test
--------------------------------------------------------------------------
name        test
rule        1
rank        0
descr
conditions  dest ipaddr = 10.1.1.1 mask 255.255.255.255
action
--------------------------------------------------------------------------
1 record displayed
```

Displaying ACLs and Rules

Use the `show acl` command to display configured ACLs or their component rules. This command shows configured ACLs regardless of whether they are attached to an I/O Module or not.

When you display ACLs and rules, you can show all ACLs on the system or, if you specify an ACL name, information for only that ACL is displayed. The output of the `show acl` command displays:

- ACL name
- number and rank of any rule configured in each ACL
- an optional description (if present)
- conditions and actions for each rule in the ACL

Syntax

```
show acl
show acl {*|<name>}
```

Parameter Description

{*|<name>}—Enables displaying information about all ACLs or a specific ACL.

Examples

Display all ACLs on the system.

```
show acl *
name                    rule rank descr conditions action
-------------------------------------------------------------------------------
renoset                 1    0                    allow, learn both
renoset                 2    0          src
                                        ipaddr
                                        exactly
                                        192.168.1.1/32
test                    1    0          dest
                                        ipaddr
                                        exactly 10.1.1.1
web100m                 1    0          dest port  allow,
                                        exactly 80 police=test/100mhttp both
4 records displayed
Display an ACL by name ("renoset") and its rules.
show acl renoset
name    rule rank descr conditions                      action
-------------------------------------------------------------------------------
renoset 1    0                                          allow, learn both
renoset 2    0          src ipaddr exactly 192.168.1.1/32
2 records displayed
```

Display an ACL by name ("renoset") and its rules.

```
show acl renoset
name    rule rank descr conditions                      action
-------------------------------------------------------------------------------
renoset 1    0                                          allow, learn both
renoset 2    0          src ipaddr exactly 192.168.1.1/32
2 records displayed
```

Removing ACLs

Use the `remove acl` command to delete configured ACLs on the system. This command can remove a rule, an entire ACL, or all ACLs.

Note – If you need to change an ACL rule, you do not need to remove the rule. You can change the rule in real-time while the ACL is still attached to an I/O module by issuing the `set acl` command to rewrite the rule

Syntax

```
remove acl <acl-name>
remove acl *
remove acl <acl-name> rule <id>
```

Parameter Description

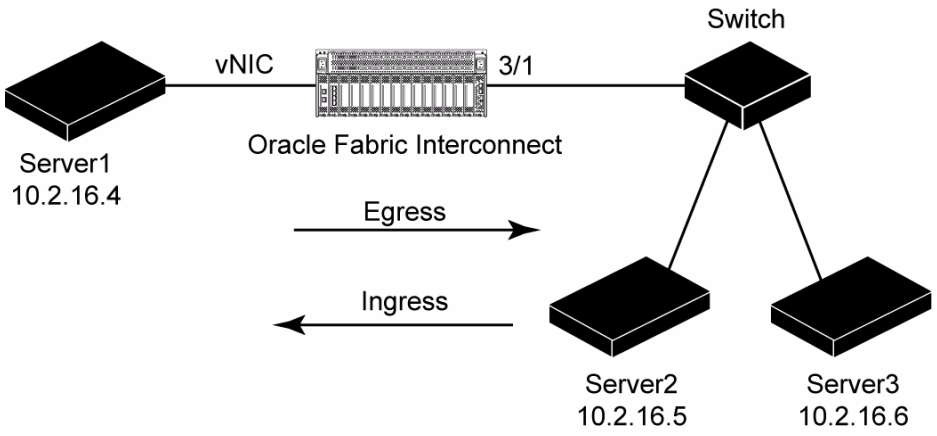
Parameter	Description
`<acl-name>`	Removes a single ACL.
`*`	Removes all ACLs.
`rule <id>`	Removes a single rule from the ACL Rule Set

Example

```
remove acl *
Remove all ACLs (y/n)?y
```

Example: Denying Egress Traffic

This example creates an ACL that blocks any traffic heading in an egress direction (server to network) where the destination IP address is equal to 10.2.16.5.



▼ Deny Egress Traffic

Take the following steps to deny egress traffic:

1. **Create a named policy set (empty by default).**

   No implicit assumptions or rules are made in this empty set.

   The set in this example is named "block16_5":

```
add acl block16_5
Warning: ACLs are not autocommitted.  You will need to enter
'commit' when the ACL is complete
```

Note – As indicated by the display message, the `commit` command must be issued after you define the condition and action. See Step 3.

2. **Add a rule to the named set, then specify an action and condition.**

   Rule numbers must be between 1 and 1024:

```
set acl block16_5 rule 1 action deny egress
set acl block16_5 rule 1 condition dest ipaddr = 10.2.5.16 mask 255.255.255.255
```

In this example, any traffic that exits the Oracle Fabric Interconnect I/O card is considered the `egress` direction (server to network). The `condition` matches on destination IP address 10.2.5.16 with a 32-bit mask length. All other traffic is permitted to pass through except that destined for 10.2.5.16.

For a list of condition definitions, see "Setting Conditions" on page 216.

3. **Issue a commit after the ACL is defined:**

```
commit
Are you sure you want to commit these changes (y/n)?y
```

This command collects all the multiple configuration steps of your policy and stores them into the chassis' database.

4. **Specify the I/O card and apply the named ACL:**

```
set ethernet-card 3 acl -set=block16_5
```

The same set can be attached to multiple cards (one at a time). Once attached, the policy is downloaded and programmed into the card. The defined conditions and actions will be applied to each packet passing through the card and its ACL rule set.

5. **Verify the ACL was assigned to the I/O card.**

Look for the "a" field next to the "enables" In this example, QoS (q) is also enabled:

```
show -list iocard 3
-------------------------------------------------------------------
slot      3
state     up/up
descr
type      nwEthernet1Port10GbCard
vnics     12
qos
acl       block16_5
enables   qa-
-------------------------------------------------------------------
1 record displayed
```

6. **Display the contents of the ACL policy:**

```
show -list acl
-------------------------------------------------------------------
name         block16_5
rule         1
rank         0
descr
conditions   dest ipaddr = 10.2.5.16 mask 255.255.255.255
action       deny, forget egress
```

7. **Display ACL statistics.**

   In this example, the "acl-deny-pkt-counter" is equal to "6", which indicates packets are being dropped (as expected):

```
show iocard 3 acl-stats
name                          block16_5
acl-rule-set                  1
acl-rule                      1
acl-deny-pkt-counter          6
acl-mark-tos-counter          0
acl-mark-dot1p-pkt-counter    0
acl-enqued-pkt-counter        0
acl-learned-flows-counter     0
-------------------------------------------------------------------
1 record displayed
```

8. **Enable or disable an ACL:**

```
set ethernet-card 3 disable -acl
set ethernet-card 3 enable -acl
```

9. **Disable the ACL set on the I/O card:**

```
set ethernet-card 3 acl -set=none
```

10. **Remove the ACL:**

```
remove acl block16_5
```

CHAPTER 13

Link Aggregation Groups (LAGs)

A link aggregation group (LAG) is a grouping of physical Ethernet ports, which enables you to combine multiple individual physical Ethernet ports into one logical port group. As a result, the ports combined into a LAG can operate in parallel with the benefit of increased bandwidth and high availability.

This chapter explains how to configure a LAG and provide those benefits to your virtual resources. It contains the following sections:

- "Employing LAG" on page 225
- "LAG Commands" on page 228

Employing LAG

When you configure LAG, you specify a group a name consisting of a slot number and LAG ID from 1 to 5, then assign ports from the same module to the group. At least one port must be specified when you initially create the LAG.

Virtual NICs can be bound to a LAG when the vNICs are created. If you are configuring a vNIC in a LAG, you must configure the LAG first. By doing so, you make the LAG available as a selectable object.

LAGs are connections that make a fatter pipe out of the individual Ethernet ports. LAGs are assigned on a one-to-one basis between the Oracle Fabric Interconnect and the peer Ethernet device. Therefore, the same port(s) cannot be assigned to multiple LAGs. For example, ports 1 through 5 cannot be assigned to LAG 2 and LAG 4.

LAGs are supported on the 10-Port GE module and 4-Port 10 GE module only. (The 10 GE Module has only one port, and therefore, does not support LAGs.) The OVN implementation of LAG was designed with guidelines from the IEEE 802.3ad LAG standard.

Note – In many ways, configuration and management of LAGs is similar to configuration and management of Ethernet ports.

Link Aggregation Control Protocol (LACP)

The OVN implementation of LAG supports Link Aggregation Control Protocol (LACP) to manage link aggregation. LACP allows a network device to negotiate an automatic bundling of links by sending LACP packets to the peer device, which must also support LACP. the Oracle Fabric Interconnect supports static and dynamic LAGs. The presence of LACP in the LAG determines whether it is static or dynamic LAG. The following table summarizes how LACP applies to static and dynamic LAGs.

LACP Used?	Type of LAG	Comments
No	Static	When using a static LAG, LACP must be disabled. LACP is not used in static LAGs, and ports are and deleted manually.
Yes	Dynamic	When using a dynamic LAG, LACP must be enabled. When LACP is enabled, the Oracle Fabric Interconnect does not initiate LACP packets, but does understand incoming LACP packets, which act similar to a heartbeat between the Oracle Fabric Interconnect ports and the ports on the peer device. The peer device initiates negotiation by periodically sending out an LACP packet. The Oracle Fabric Interconnect receives and replies to the packet, eventually forming the LAG based on which ports respond to the LACP packet.

With LACP, ports are dynamically added and removed from the LAG:

- Ports are added when they respond to the peer's LACP packet, which is sent continuously at regular intervals.
- Ports are deleted by timing out if they do not answer the LACP packet in a timely manner.

LACP is included in IEEE specification as a method to control the bundling of several physical ports together to form a single logical channel. LACP is a subset of the IEE 802.3ad standard.

Port Assignment in the LAG

When you initially create a LAG, you must specify at least one of the 10-Port GE modules ports. After the LAG is created, you can add individual ports to the LAG.

When a LAG contains multiple ports, traffic is mapped to the appropriate port based on a hashing algorithm that considers the following parameters of the packets originating from the vNICs in a LAG:

- Source and destination MAC address and (if applicable)
- IPv4 source and destination addresses and (if applicable)
- TCP and UDP source and destination ports (if applicable)

Ports that are assigned to a LAG remain part of the LAG regardless of their state. If a port is in the up/up state, and transitions to the up/down state, the port does not leave the LAG. Instead, it remains a member of the LAG but does not support traffic until it transitions back to the up/up state. When the port returns to the up/up state, it can resume operation in the LAG. However, only new traffic flows may be assigned to this port. Existing traffic flows are not remapped onto the port when it comes back up.

Ports membership in a LAG is statically assigned by you. Ports are not dynamically added or deleted based on LAG changes on the peer Ethernet switch. As a result, any time you make a LAG change on the peer device at the end of the Gigabit Ethernet link, you must make the corresponding change to the LAG on the Oracle Fabric Interconnect.

LAG Considerations

As a general rule, the LAG configured on the Oracle Fabric Interconnect must match the LAG configuration on the peer device at the other end of the Ethernet link. Specifically, you should be aware of the following considerations:

- A LAG consists of multiple physical ports of the same speed on the 10-Port GE module. A LAG consisting of all 1 GB links is valid, but a LAG with a mixture of 1 Gbps and 100 Mbps cannot be created.
- Link properties between the Oracle Fabric Interconnect and the peer Ethernet device must be identical at both ends of the LAG. Some examples:
  - Link speed. Be aware that auto-negotiation on the peer Ethernet device can cause link speed to change.
  - Full duplex mode. OVN LAGs support only full-duplex communication.
  - MTU size on the link.
- These settings must be identical on both ends of the LAG. They cannot be changed for the LAG in runtime, so be sure that they are identical before creating the LAG and populating it with ports.
- A LAG's ports must all reside on the same Oracle Fabric Interconnect slot. For example, you cannot create a LAG from ports on slot 5 and slot 6.

- LAG port changes are not revertive. As a result, if a port in the LAG goes down, traffic flows are remapped based on the hashing algorithm (see "Port Assignment in the LAG" on page 226). When the port comes back up, traffic does not revert back to the port that was originally supporting the traffic. Only new traffic flows can be mapped onto this port.

LAG Numbering

The Oracle Fabric Interconnect uses a slot and port numbering convention to identify the physical port that is the termination point for a vNIC. However, when you use a LAG, the standard slot and port numbering convention is not used. Instead, when you specify a LAG, you use a slot and a LAG ID from 1 to 5 separated by a period (.). For example, to specify LAG 4 on slot 5, you would identify that LAG as 5.4. Be aware that LAGs require a period (not a slash) to differentiate them from a standard slot and port termination.

LAGs, like most objects in the Oracle Fabric Interconnect, have "Naming Conventions" on page 8.

LAG Commands

LAGs are supported on the Oracle Fabric Interconnect through the `add lag`, `set lag`, `show lag`, and `remove lag` commands. Be aware that the LAG must also be configured on the peer Ethernet device.

Syntax

```
add lag <name> port <port-number> -lacp
set lag {<*|*.*|<name>} -access-vlan=<number>|default
set lag {<*|*.*|<name>} -descr=<value>
set lag {<*|*.*|<name>} -flow-control=default|false|true
set lag {<*|*.*|<name>} -igmp-snooping=default|false|true
set lag {<*|*.*|<name>} -mode=access|trunk
set lag {<*|*.*|<name>} -mtu=<number>|default
set lag {<*|*.*|<name>} -rate=100m|1g|autoNegotiate|default
set lag {<*|*.*|<name>} -tag-native=true | false
show lag {*|*.*|<name>}
show ethernet-port {*|<name>}
remove lag {*|*.*|<name>}
```

Parameter Description

Parameter	Description
`* | *.*`	Wildcards that enable applying the command to all LAGs on the Oracle Fabric Interconnect.
`port <port-number>`	Specifies the port that will be added, deleted, or have its parameters set.
`-lacp`	Specifies whether or not passive-mode LACP is supported on the port. By specifying the `-lacp` qualifier, the specified port(s) will be dynamically added to a LAG.
`<slot-number>.*`	Focused wildcard that enables applying the command to all LAGs on a specific slot number.
`<name>`	A LAG name (which consists of slot and LAG ID separated by a dot) that enables applying the command to a specific LAG.
`-access-vlan=`	Specifies the access VLAN ID of the LAG. In the Access VLAN domain only untagged packet are transmitted or received by default unless the `-tag-native` qualifier is used.
`-descr=`	Specifies an optional alphanumeric character string that describes the LAG.
`-flow-control`	Specifies whether flow control (standard MAC flow control) is enabled on the LAG. By default, flow control is disabled (default), but you can enable flow control with the keyword true, or disable flow control with the keyword false.

Parameter	Description
`-igmp-snooping=`	Specifies whether IGMP Snooping is enabled for the LAG.
`-mode`	Specify access mode (access) or trunk mode (trunk) of operation: • In access mode, the LAG carries only transmitted or received packets in the Access VLAN domain. • In trunk mode, all VLAN traffic is transmitted or received by the LAG.
`-mtu=`	Sets the maximum size of packet transmitted without fragmentation. Specify a number between 1500 and 9194. By default (default) 1500-byte packets are used.
`-rate=`	Sets the link speed to 100 Mbps (100m) or 1 Gbps (1g) or allows for autonegotiation (`autoNegotiate`) between the Oracle Fabric Interconnect port and the peer Ethernet device. By default, autonegotiation (default) is used.
`-tag-native=`	Specifies whether untagged packets are tagged with the native VLAN ID (also called access VLAN ID) of the source vNIC. • By specifying true, you allow untagged packets to a be tagged with the appropriate VLAN ID when they are transmitted or received between the Oracle Fabric Interconnect and its peer device. • By specifying false, untagged packets are not tagged with a VLAN ID.
`-lacp-enable=`	Specifies an option which enables or disables LACP on the LAG.

LAG Configuration Options

This section documents some examples of setting options for the LAG. Be aware that setting options on the LAG might also require you to set the corresponding value for the peer Ethernet device's LAG. configuration. For example, setting an MTU size on the Oracle Fabric Interconnect side of the LAG requires you to set the corresponding MTU size for the LAG on the peer device.

To set LAG options, no vNICs can be assigned to the port. As a result, if a port is unassigned to a LAG, and you want to assign it to a LAG., you must:

1. Delete any vNICs supported by the port.
2. Add the port to the LAG.
3. Add the vNICs to the port.

The following series of commands shows you how to set LAG options individually, but you can specify them all in one command.

For example:

```
set lag 5.4 -access-vlan=2400 -flow-control=true -mtu=4906 -rate=100m
```

This command accomplishes the same task as the individual commands in the following examples:

To set the access VLAN ID, you would issue the `set lag <name> -access-vlan` command. For example, to set the native VLAN ID to 2400 for LAG 5.4:

```
set lag 5.4 -access-vlan=2400
```

To enable flow control, you would issue the `set lag <name> -flow-control` command. For example:

```
set lag 5.4 -flow-control=true
```

To set the MTU for the LAG, you would issue the `set lag <name> -mtu` command. For example, to set the MTU size to 7184 bytes:

```
set lag 5.4 -mtu=4906
```

To set the link rate for the LAG, you would issue the `set lag <name> -rate` command. For example, to set the link rate for 5.4 to 100 Mbps:

```
set lag 5.4 -rate=100m
```

Note – After setting the LAG options, it is good idea to issue the `show lag` command to verify the configuration changes.

Example LAG Configuration for Peer Device

This section shows an example of configuring a peer device with LAG trunking so that it is compatible with the Oracle Fabric Interconnect. For this example, assume that the peer device is a Cisco Gigabit Ethernet switch.

Commands on peer:

```
config term
interface range GigabitEthernet1/0/23-24
switchport mode trunk
switchport trunk encapsulation dot1q
switchport trunk allowed vlan 10,99
channel-group 1 mode on
```

There is no dependency for when to configure the peer or the Oracle Fabric Interconnect, so these commands can be issued on the peer before or after LAG is configured on the Oracle Fabric Interconnect.

Configuring a Static LAG

This section documents creating a LAG with default values:

- autonegotiation
- a 1500-byte MTU
- access mode for VLANs supported in the LAG
- native (or access) VLAN ID is 1.

This procedure assumes that you are creating a LAG with LAG ID of 4, on a 10-Port GE module on slot 5, ports 7, 8, and 9.

▼ Configure a Static LAG

1. **Configure the LAG on the peer Ethernet switch.**
2. **Create the LAG on the Oracle Fabric Interconnect by issuing the `add lag` command and specifying the first port that you want in the LAG.**

   For example:

```
add lag 5.4 port 7
```

Note – Each 10-Port GE Module can support up to 5 LAGs.

3. **Repeat Step 2 to add individual ports to the LAG.**

Note – Total number of ports that you can add to a LAG depends on the number of LAGs configured, with the maximum number of ports ranging from 10 configured in a single LAG to 2 ports configured in each of five LAGs.

4. **When all ports have been configured in the LAG, verify that the LAG was correctly added to the Oracle Fabric Interconnect, by issuing the** `show lag` **command.**

```
show lag
name  state  descr  rate  mtu   mode    access-vlan  flags  ports  vnics
------------------------------------------------------------------
5.4   down          auto  1500  access  1            -s-    9,8,7    0
1 record displayed
```

   The contents of the flags field differs based on the options configured on the LAG. Valid flags are:

   - s flag indicates IGMP snooping is enabled
   - t flag indicates that tag native VLANs is enabled
   - f flag indicates flow control is enabled

5. **Set specific LAG parameters by issuing the** `set lag` **command.**

   For some examples, see "LAG Configuration Options" on page 230.

6. **Configure vNICs that terminate on the LAG, by issuing the** `add vnic` **command.**

Configuring a Passive Mode LAG

You can configure a passive mode LAG as follows:

- "Configure a LAG for "Passive" Mode (Dynamic LAG)" on page 234
- "Configure Individual Ports for Passive Mode LACP" on page 235

▼ Configure a LAG for "Passive" Mode (Dynamic LAG)

When configuring a passive-mode LAG, you configure a LAG on the Oracle Fabric Interconnect and use the `-lacp` qualifier to allow passive mode. Passive-mode LAGs are formed dynamically through LACP, when a peer device is set to active mode and requests that the passive port is added to the LAG.

1. **Configure the LAG on the peer. The LAG must be configured for "active" mode.**

2. **On the Oracle Fabric Interconnect, add the lag and set the appropriate port(s) to passive-mode LACP.**

   For example, to add a LAG called 3.2 with port 2, and enable the LAG for passive LACP:

```
add lag 3.2 -lacp port 2
```

3. **Use the `add lag` command to add the other ports that will be in the passive-mode LAG.**

   For example, to add ports 3/8 and 3/10 to LAG 3.2:

```
add lag 3.2 -lacp port 8
add lag 3.2 -lacp port 10
```

   As an option, you can use wildcards as options to specify multiple LAGs or multiple ports within one LAG. For example:

```
add lag *.1 -lacp port 1
add lag 3.* -lacp port 10
```

   In the first example, all LAGs are configured with port 1, and all LAGs support passive-mode LACP. In the second example a LAG is created on slot 3 and all ports in that slot are members of the LAG, and the LAG supports passive mode LACP.

4. **When all ports have been configured in the LAG, verify that the LAG was correctly added to the Oracle Fabric Interconnect, by issuing the** `show lag` **command.**

```
show lag
name  state  descr  rate  mtu   mode access-vlan  flags  ports  vnics
-------------------------------------------------------------------
5.4   down          auto  1500  access  1            -s-l 9,8,7  0
1 record displayed
```

The contents of the flags field differs based on the options configured on the LAG. Valid flags:

- `s` flag indicates IGMP snooping is enabled
- `t` flag indicates that tag native VLANs is enabled
- `f` flag indicates flow control is enabled
- `l` flag indicates that LACP is enabled on the LAG.

▼ Configure Individual Ports for Passive Mode LACP

Individual ports can be set for LACP when they are added to the LAG. Specify the `port <port-number>` option of the `add lag` command to add the ports, and use the -lacp option to set each port to passive-mode LACP. Ports must be added individually. You cannot use wildcards, hyphenated lists, or comma-separated lists when adding ports to an existing LAG. You cannot mix passive-mode and non-passive mode ports in the same LAG.

For example, to add another port (3/8) to the LAG 3.2 and have port 3/8 support LAG.:

```
add lag 3.2 -lacp port 8
```

Ports in a static LAG can be configured for pass-vie mode LACP, but not on-the-fly. If a port is already part of a static LAG and you want to change it to passive-mode LACP, you will need to:

1. **Delete the port from the LAG (**`remove lag <name> port <num>`**).**
2. **Add the port back to the static LAG, making sure to specify the** `-lacp` **qualifier for the port.**

Deleting a LAG

You can delete a LAG at any time by issuing the `remove lag` command. Whenever you delete a LAG, remember to delete the LAG on the Oracle Fabric Interconnect's peer Ethernet device (if needed). The `remove lag` commands supports:

- "Delete All LAGs from an Oracle Fabric Interconnect" on page 236
- "Delete All LAGs from a 10-Port GE Module" on page 236
- "Delete a Single LAG from a 10-Port GE Module" on page 237
- "Delete a Port from a LAG" on page 237

If you delete a LAG that contains any ports, a confirmation warning is displayed. Deleting a port from a LAG can potentially cause a delay in packet transmission and reception on the vNICs that are configured on the port. This potential delay is temporary as traffic flows are remapped to another port in the LAG, and while TCP retransmits the packets. If you delete an empty LAG, the confirmation warning is not displayed.

Delete All LAGs from an Oracle Fabric Interconnect

To delete all LAGs from a Chassis, use the `remove lag` command and the wildcard options—either * or `*.*`

```
remove lag *
Removing LAGs may disrupt virtual network traffic.  Remove all LAGs
(y/n)?y
```

Delete All LAGs from a 10-Port GE Module

To delete all LAGs from a specified 10-Port GE Module, issue the `remove lag` command plus the <slot-number>.* argument for a focused wildcard. For example to delete all LAGs from module 5:

```
remove lag 5.*
Removing LAGs may disrupt virtual network traffic.
Remove all LAGs on card 5 (y/n)?y
```

Delete a Single LAG from a 10-Port GE Module

To delete all LAGs from a specified 10-Port GE Module, issue the `remove lag` command plus the LAG name (which is a slot and LAG ID separated by a dot). For example, to remove LAG 5.4:

```
remove lag 5.4
Removing LAGs may disrupt virtual network traffic.
Remove LAG 5.4 (y/n)?y
```

Delete a Port from a LAG

You can delete individual ports from a LAG at any time, regardless of the port's state. If you delete the last port from the LAG, the LAG itself remains configured as an empty object. To delete a port from a LAG, issue the `remove lag` command plus the LAG name and port number. For example, to delete port 8 from LAG 5.4:

```
remove lag 5.4 port 8
Removing LAG ports may disrupt virtual network traffic.  Remove
port 8 from
LAG 5.4 (y/n)?y
```

If you delete the last port from the LAG, the LAG itself remains configured as an empty object. For example:

```
show lag 5.4
name  state  descr  rate     mtu   mode    access-vlan  flags  ports  vnics
-------------------------------------------------------------------------
5.4   down           100Mbps  4906  access  2400         -s-           0
1 record displayed
```

In this example, the `ports` field shows no Ethernet ports. As a result, LAG 5.4 remains configured but is an empty set.

Delete an Ethernet Port from a Passive Mode LAG

Deleting a port from a passive-mode LAG is the same process as deleting a port from a static LAG. You do not need to first disable LACP. Instead, just issue the `remove lag` command and specify the port number or an optional wildcard:

```
remove lag 3.2 port 8
Removing LAG ports may disrupt virtual network traffic.
Remove port 8 from LAG (y/n)?y
```

CHAPTER 14

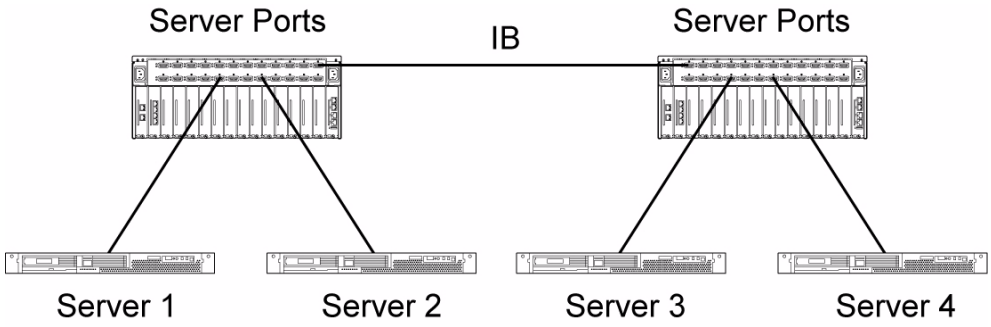
Clusters

This chapter explains cluster configuration in the following sections:

- "Virtual I/O Fabric" on page 239
- "OpenSM Decoupling" on page 244

Virtual I/O Fabric

Virtual I/O Fabric enables you to expand the size of your virtual I/O capabilities by interconnecting multiple Oracle Fabric Interconnects together. From an IB perspective, a multi-chassis configuration appears as a single IB subnet:



Clustered I/O, where all the I/O ports on multiple chassis function as a single logical resource, is not supported. The following are also not supported:

- Link Aggregation Group members across multiple chassis.
- Moving a vNIC interface between chassis.

The Oracle Fabric Interconnect also supports a decoupled Subnet Manager (SM), which is part of a cluster environment. OFED 1.1 and 1.2 are supported on external IB attached servers that run SM functions. See "OpenSM Decoupling" on page 244 for more information.

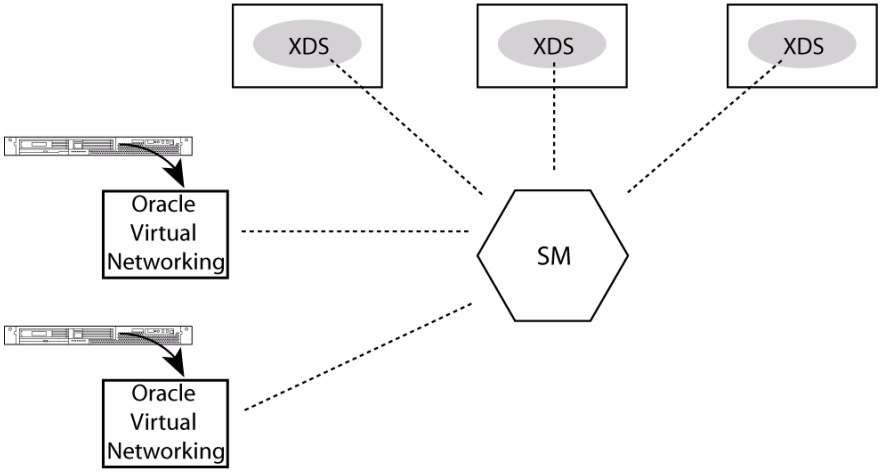
Xsigo Directory Service

The Xsigo Directory Service Daemon (XDSD) maintains a database of all the reachable chassis and host servers in the cluster. XDSD runs as an instance on each Oracle Fabric Interconnect and is enabled by default.

XDSD' core functionality is to do the following:

- Accept XCM records from each chassis XCM.
- Accept requests from servers for XCM records.
- Node name registration and query.
- XDS election process.

When a Oracle host driver starts up, it has no information on where XDS is running. However the driver does detect where the SM is running:

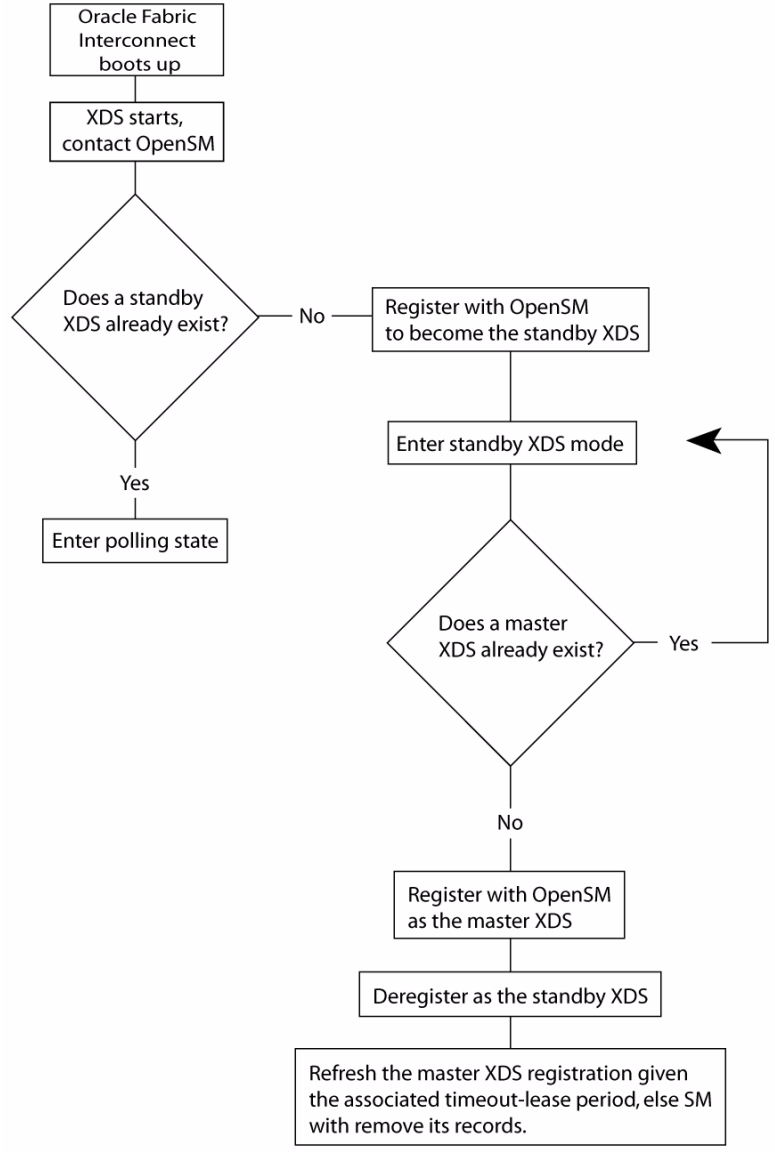


The SM can run on the Oracle Fabric Interconnect chassis or any external host server. There is no requirement to run SM on an Oracle Fabric Interconnect chassis. See "OpenSM Decoupling" on page 244.

XDS Registration Process

On initial boot up, the Oracle Fabric Interconnect starts an XDS registration process to determine which chassis becomes the master XDS and which chassis becomes the standby XDS. The Oracle Fabric Interconnect that registers first with SM becomes the master. The registration algorithm is first-come-first-serve.

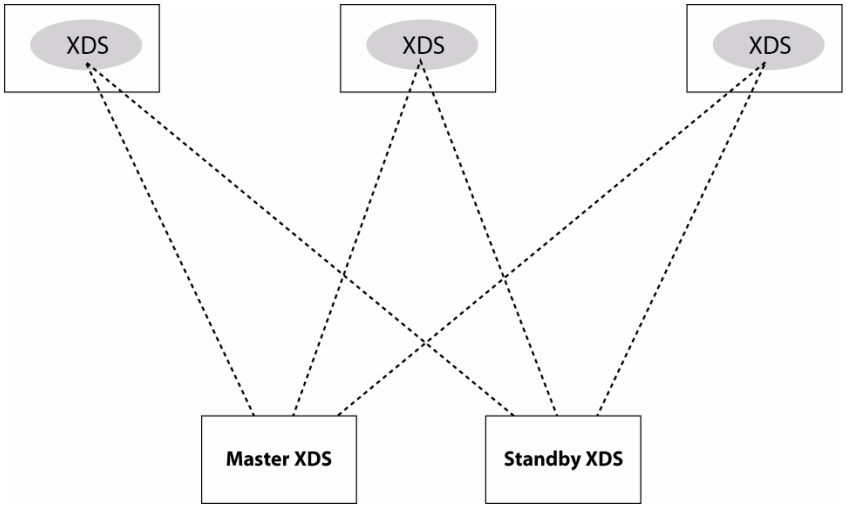
The following figure describes the XDS registration process:


Oracle Fabric Interconnect boots up
XDS starts, contact OpenSM
Does a standby XDS already exist?
No
Register with OpenSM to become the standby XDS
Enter standby XDS mode
Yes
Enter polling state
Does a master XDS already exist?
Yes
No
Register with OpenSM as the master XDS
Deregister as the standby XDS
Refresh the master XDS registration given the associated timeout-lease period, else SM with remove its records.

A chassis first becomes a standby XDS, then a master. Only a standby XDS can become a master. This approach enables the system to always have backup information, which avoids conditions where SM or a master XDS dies. In these cases, all state information would be lost.

Add Server Profiles

Regardless of the number of chassis in your network, there is only one designated master and one designated standby.



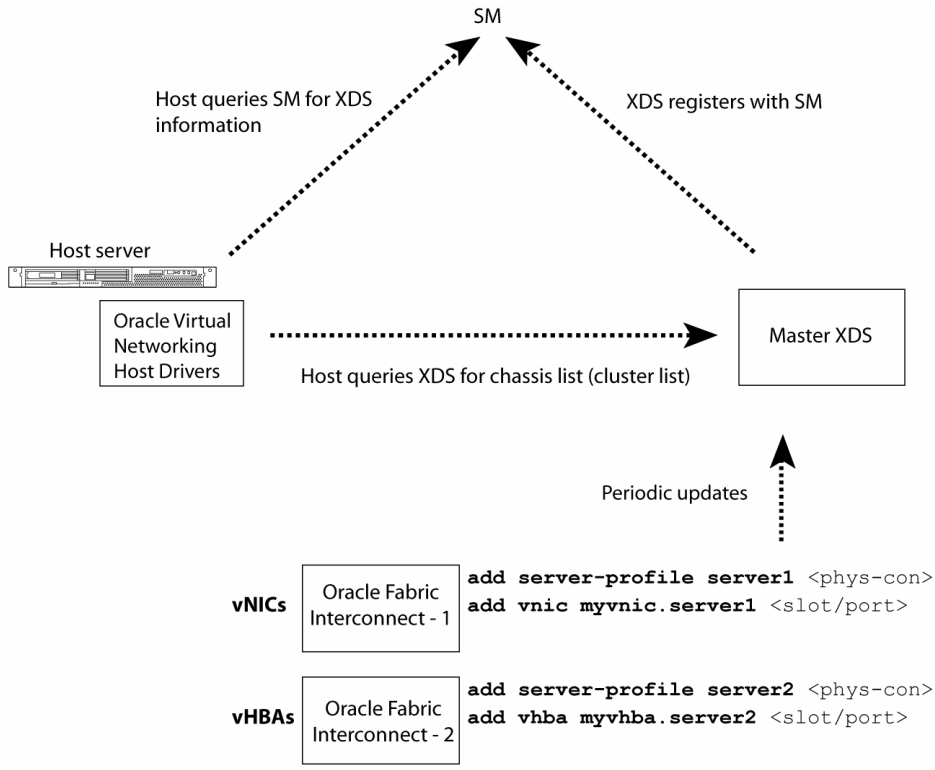
After the master and standby XDS are identified, each cluster member can participate in server-profile creation.

When you issue the `add server-profile` command, for example:

```
add server-profile <name> <server-name>@<f1-15>:ServerPort<num>
```

The Oracle Fabric Interconnect sends this server record to both the master and standby XDS. This record is retransmitted at periodic intervals. To ensure database synchronization, each cluster member sends periodic updates to both the master and standby XDS. If the master XDS fails, the standby will become the master and another Oracle Fabric Interconnect in the cluster will become the new standby.

Each host server knows the address for SM, which in turn sends the master XDS address to the host server. However, the host server has no knowledge of a standby XDS. The master XDS provides a list of chassis-cluster members to the host server.



In the figure, different virtual resources (vNICs and vHBAs) have been configured on server profiles on two different Oracle Fabric Interconnnect chassis.

The flow of operation is as follows:

1. The XDS registers with SM.
2. The Oracle host drivers query SM for XDS location information.
3. The Oracle host drivers query XDS for the cluster (chassis) list. (This list information is used by the host server to install virtual resources accordingly.)

OpenSM Decoupling

Xsigo's OpenSM can be disabled and replaced by a third party Subnet Manager (SM). Some customers prefer to use their own version of InfiniBand SM because it includes custom extensions and can be managed externally to the Oracle Fabric Interconnect.

Note – Certain SMs are qualified to work with the Oracle Fabric Interconnect. Contact Oracle customer support for more information.

Use the `set system is-subnet-manager` command to control the OpenSM process running on the chassis. By default, the OpenSM process starts automatically.

For more information about OpenSM, see "InfiniBand Ports" on page 19.

Syntax

```
set system is-subnet-manager {true|false|default} [-noconfirm]
show system info
```

Parameter Description

Parameter	Description
`set system is-subnet-manager`	Controls the OpenSM process. There are three keyword options. The true option enables OpenSM. The false option disables OpenSM. The default returns OpenSM to its factory default setting, which is true.
`-noconfirm`	Controls whether a confirmation prompt is displayed whenever you change the setting for subnet management authority.
`show system info`	Displays OpenSM state information. See the "is-sm" flag.

Example

The `show system info` command displays the "`is-sm" flag`, reflecting the current state of OpenSM:

```
show system info
------------------------------------------------------------
hostname          iowa
domain            lab.xsigo.com
address           192.168.8.133
netmask           255.255.252.0
```

```
nameservers      192.168.8.3, 192.168.8.2
model-num        F1-15-CH-SDR
serial-num       050610240
ipconfig         dhcp
default-gateway  192.168.8.1
timezone         GMT
domain-search
is-sm             true
console-speed    115200
phone-home       true
root-ssh-login   enabled
-------------------------------------------------------------
1 record displayed
set system is-subnet-manager false
Are you sure you want to relinquish subnet manager authority?  If
there are no other subnet managers available, your subnet may
become unmanaged (y/n)?y
show system info
-------------------------------------------------------------------
hostname         iowa
domain           lab.xsigo.com
address          192.168.8.133
netmask          255.255.252.0
nameservers      192.168.8.3, 192.168.8.2
model-num        F1-15-CH-SDR
serial-num       050610240
ipconfig         dhcp
default-gateway  192.168.8.1
timezone         GMT
domain-search
is-sm             false
console-speed    115200
phone-home       true
root-ssh-login   enabled
-------------------------------------------------------------------
1 record displayed
set system is-subnet-manager true
Are you sure you want to become a subnet manager?  This may cause
this Xsigo system to grab ownership of the subnet from another
manager (y/n)?y
```

CHAPTER 15

User Authorization and Access Control

Oracle's Identity Management System (IMS) service authenticates users and grants them suitable privileges according to assigned user roles when users access the Oracle Fabric Interconnect. The IMS service can be one of:

- XgOS local system, which is always present
- Microsoft *Active Directory* (AD)
- Remote Authentication Dial In User Service (*RADIUS*)

Once you apply the configuration, the IMS service is completely transparent to the operator.

The IMS server functions as a central authentication, authorization, and accounting (AAA) repository. You can use either the internal (local) IMS or an external IMS to control authorization. The internal service is always in place to ensure that you can always log in to the chassis using a local account in the event that connections to an external service are lost.

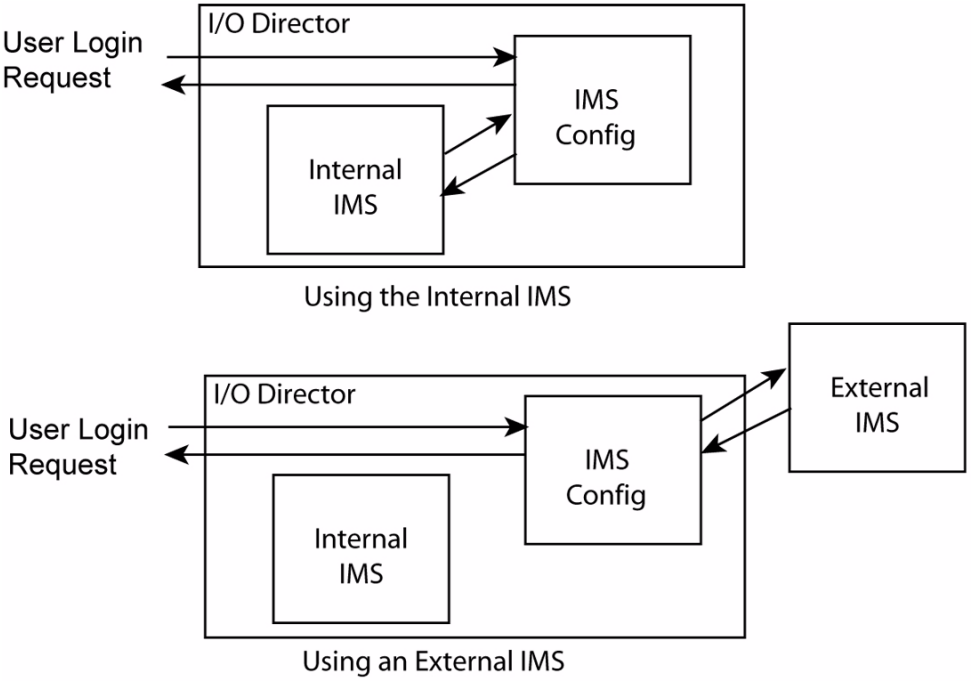
You can choose to use only the internal IMS if it meets your needs. However, many users will want to take advantage of pre-existing user accounts on another system. In that case, you can configure an external IMS and those users will also have access.

This chapter provides information about the IMS and the local and external systems that you can use. It contains the following sections:

- "Configuring IMS" on page 248
- "Using the Internal IMS" on page 250
- "Using Active Directory as the IMS" on page 254
- "Using Role Group Mappings for AD/LDAP Users" on page 259
- "Using RADIUS as the IMS" on page 265
- "Common IMS Operations" on page 269
- "Setting the Shell Inactivity Timeout for Root User" on page 270

Configuring IMS

The following figure shows how the Oracle Fabric Interconnect handles a login request when using the internal IMS and when using an external system.



If you want to use the internal IMS, all you need to do is add any necessary user accounts as described in "Using the Internal IMS" on page 250. If you would like to use an existing identity management system, the process follows:

1. Set up your external system as described in the appropriate section of this chapter.
   - If you are using Active Directory, follow the instructions in "Using Active Directory as the IMS" on page 254.
   - If you are using RADIUS, follow the instructions in "Using Role Group Mappings for AD/LDAP Users" on page 259.
2. Set the IMS in the Oracle Fabric Interconnect to your external system.
3. Use the `set ims` command to specify your configured identity management system.

Syntax

```
set ims -cache-timeout=[<number> default]
set ims -maps-to-root=<value>
set ims -search-order=[default|externalFirst|internalFirst]
set ims -server-type=[default|ldap_ad |local_only|radius]
set ims -token-timeout=[<number>][default]
set ims {ad-server|radius-server|radius-user} <name> <options>
show login
system flush ims
```

Parameter Description

Parameter	Description
`-cache-timeout`	The cache time-out value is the number of minutes that XgOS maintains a local copy of authentication and access information retrieved from an external IMS. Accepted values are from zero to 1440 minutes. The default value is 240 minutes. A value of zero disables the cache. For an example of using this option to control the time information is kept in the cache, see "Example: Control Cached Authentication Data" on page 269.
`-maps-to-root`	`root` for RADIUS or `users` for AD.
`-search-order`	Use this option to specify the order in which the Oracle Fabric Interconnect searches when responding to a login request. Enter one of: `default`: use the default local IMS. `externalFirst`: search the external IMS and use the local one only if the request fails. `internalFirst`: search the internal IMS and use the external one only if the request fails. For an example of using this option to control search order, see "Example: Display the IMS Search Order" on page 269.
`-server-type`	Indicates the kind of IMS server to be used. Enter one of: • `default`: the local IMS. • `ldap_ad`: an Active Directory server. • `local_only`: the local IMS. • `radius`: a RADIUS server. • `ldap_ibm`: reserved for future use • `ldap_sun`: reserved for future use

Parameter	Description
`-token-timeout`	Use this option to control the authentication token time-out. Accepted values are from 1 to 1440 minutes. The default value is 5 minutes.

Refer to "Using Active Directory as the IMS" on page 254 or ""Using Role Group Mappings for AD/LDAP Users" on page 259 for examples of setting the IMS to a particular type of server.

Using the Internal IMS

XgOS's internal IMS, called "local," comes installed with a predefined administrator (`admin`) account. You can add users with different roles, to grant or restrict access to different virtual resources.

User accounts and roles are interrelated:

- You create user accounts to grant people access to the chassis.
- The roles that a user has determine which objects the user can modify.

XgOS also supports external IMS servers such as Microsoft Active Directory and RADIUS. This section describes the Oracle Fabric Interconnect's local system, which is always present. For information about external systems, see "Using Active Directory as the IMS" on page 254 and "Using Role Group Mappings for AD/LDAP Users" on page 259.

User Roles

A role defines a user's privileges with regards to modifying objects. The following table lists the predefined roles in XgOS.

Role Name	Access
administrators	Allows configuration, editing, and management of all objects in the Oracle Fabric Interconnects (full administrative responsibilities)
network	Allows configuration, editing, and management of all objects related to vNIC configuration, Ethernet I/O cards and ports, network QoS parameters, ACLs, and server profiles

Role Name	Access
operators	Allows read-only access including all `show` commands
server	Allows all operations related to a server's physical connection, compute-resource configuration, and management
storage	Allows vHBA configuration and management, Fibre Channel I/O module and ports, LUN masks, persistent mappings, and SAN QoS

If you do not specify a role for a user, the user will have the operators role (read-only privileges).

▼ Create a User Account

1. Add a user:

```
add user frank
```

2. Note that by default the user has read-only access (the `operators` role).

```
show user frank
name                  role                  descr
-----------------------------------------------------------------
frank                 operators
1 record displayed
```

3. Add storage privileges to Frank's account:

```
set user frank -role=storage
show user frank
name                  role                  descr
-----------------------------------------------------------------
frank                 storage
1 record displayed
```

4. Set a password for the user:

```
set user frank -password
New password:
New password again:
```

5. Test the new user account:

```
quit
Connection to 192.168.8.133 closed.
$ ssh frank@192.168.8.133
Password:
                    Welcome to XgOS
Copyright (c) 2007-2012 Xsigo Systems, Inc. All rights reserved.

Enter "help" for information on available commands.

pwd
/home/frank
```

How Access is Controlled By User Roles

User privileges determine administrative abilities. For example, the `frank` account has operator privileges which grant read-only access to the chassis and its configuration. If this user attempts to add a user account (an administrative function), the following occurs:

```
add user intruder
User not allowed to modify/create/delete system-local:
security:user-intruder due to insufficient privileges

remove user frank
Remove user frank (y/n)?y
Failed to remove security user frank
quit
Connection to 192.168.8.133 closed.
$ ssh admin@192.168.8.133
Password:
                     Welcome to XgOS
Copyright (c) 2007-2012 Xsigo Systems, Inc. All rights reserved.

Enter "help" for information on available commands.

remove user frank
Remove user frank (y/n)?y
```

▼ Grant Privileges to a Local User Account

1. **Add the user account.**

   For example, the following adds an account named "newuser1":

```
add user newuser1 ?
Possible completions:
  [Optional qualifiers]
    -password  set password
    -role      role for user
```

2. **Attach the "user" object to a role or give it a password.**

3. **Display the available roles.**

```
add user newuser1 -role=?
Possible completions:
  administrators  Super user
  network         Create/modify/delete: Server Profile, vNIC, Ethernet card and
                  port, network QoS
  operators       Read only
  server          Create/modify/delete: Server Profile, vNIC and vHBA
  storage         Create/modify/delete: Server Profile, vHBA, Fibre channel card
                  and port, SAN QoS
```

   The default privilege (operators role) is read-only.

4. **Choose the role that the user will be assigned.**

```
add user newuser1 -role=operators
```

5. **Verify the user configuration was correctly configured:**

```
show user newuser1
name                  roles                       descr
-------------------------------------------------------------------
newuser1              operators
1 record displayed
```

Using Active Directory as the IMS

Microsoft Active Directory (AD) uses either *Kerberos* or simple (default) user authentication. You can configure up to two AD servers: one primary and one secondary. These two servers act as an active server and a hot standby in case of failures.

When using AD as the IMS, use the following process:

1. Set up the necessary user accounts as described in "Configure AD Users and Roles" on page 255.
2. You must set up these accounts before configuring the AD server in the Oracle Fabric Interconnect.
3. Configure the AD server in XgOS as described in "Example: Active Directory Server With Default Authentication" on page 256 or "Example: Configure Kerberos as a Secondary AD Server" on page 257
4. Set the IMS to the configured server.
5. For an example, see "Example: Set IMS to an AD Server" on page 258.

Syntax

```
add ims ad-server <server-name> <host[:port]> <user-dn> -domain-represented-by
    -formal-user-dn -server-mode={primary|secondary}
add ims ad-server <server-name> <host[:port]> <user-dn> -domain-represented-by
   -formal-user-dn -server-mode={primary|secondary} kerberos -default-realm
   -default-domain -kdc-host-name
remove ims ad-server <name>
set ims ad-server <name> [up|down] -authentication-type={simple|kerberos}
   -base-dn -descr -domain-represented-by-formal-user-dn -host-name -password
   -port -server-mode={primary|secondary} -user-dn
show ims [-detail]
show ims ad-server [<name>|*][-detail]
```

▼ Configure AD Users and Roles

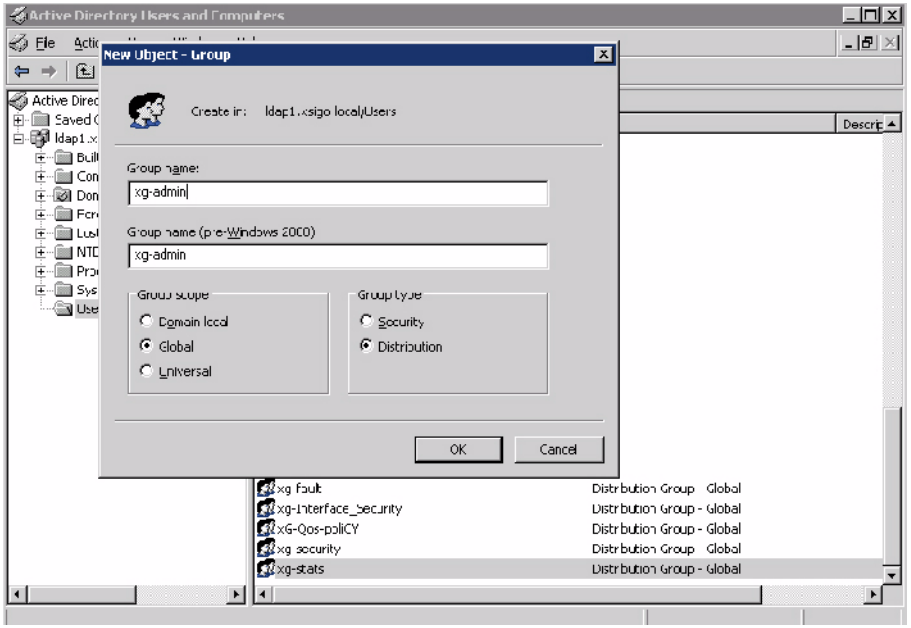
For AD to work as the IMS for the Oracle Fabric Interconnect, you must create user accounts on the AD server, and on the Oracle Fabric Interconnect, specify the AD server by its IP address, and map the AD group to a role on the Oracle Fabric Interconnect. To create the users on AD server, follow this procedure:

1. **Set up the necessary groups for your AD user accounts.**

   You will create any of the following accounts, as needed:

   - xg-administrators
   - xg-network
   - xg-operators
   - xg-server
   - xg-storage

   When you create these groups by using the interface provided by AD, remember to use Global for Group scope and Distribution for Group type as shown in the following figure.



2. **Create any new user accounts needed and assign these users to the appropriate groups.**

3. **Add existing users who need access to the Oracle Fabric Interconnect to the appropriate groups.**

4. **If you need to give everyone under in a particular group administrative access, assign that group to administrators group.**

Example: Active Directory Server With Default Authentication

This example shows how to configure an AD server with simple (default) authentication. The example takes advantage of the default settings for the port (389), the `-domain-represented-by` option (group), the server mode (primary) and the authentication type (simple).

```
add ims ad-server AD sfcorpdns1.xsigo.com user@xsigo.com "DC=XSIGO,DC=COM"
New password:
New password again:
show ims ad-server AD
------------------------------------------------------------------------------
name                 AD
descr
host-name            host-name.xsigo.com
state                up/indeterminate
authentication-type  simple
server-mode          primary
------------------------------------------------------------------------------
show ims ad-server AD -detail
------------------------------------------------------------------------------
name                      AD
descr
host-name                 host-name.xsigo.com
port                      389
state                     up/indeterminate
error
user-dn                   user@xsigo.com
base-dn                   DC=XSIGO,DC=COM
server-mode               primary
formal-user-dn
domain-represented-by     group
authentication-type       simple
kerberos-default-realm
kerberos-default-domain
kdc-host-name
kdc-port-num
------------------------------------------------------------------------------
```

Example: Configure Kerberos as a Secondary AD Server

This example configures Kerberos as a secondary AD. This example takes advantage of the default values for port (389), the `-domain-represented-by` option (group), and the `-kdc-port-num` option (88).

When configuring Kerberos, be aware of the following syntactical considerations:

- The `kerberos-default-realm` and `kerberos-default-domain` must be entered in all capital letters
- the `user-dn` can be a simple name format, for example `joe_user@xsigo.com`
- The `formal-user-dn` must be in distinguished name format, for example:
- `cn=joe_user,cn=users,dc=xsigo,dc=com`
- Each element of the `formal-user-dn` must be separated by commas, but no blank spaces.

```
add ims ad-server AD2 host-name2.xsigo.com joe@xsigo.com "DC=XSIGO,DC=COM"
    -server-mode=secondary kerberos "cn=JOE User,cn=Users,dc=xsigo,dc=com"
    XSIGO.COM xsigo.com host-name2.xsigo.com
New password:
New password again:
show ims ad-server AD2
---------------------------------------------------------------------
name                  AD2
descr
host-name             host-name2.xsigo.com
state                 up/up
auth-type             kerberos
server-mode           secondary
---------------------------------------------------------------------
show ims ad-server AD2 -detail
---------------------------------------------------------------------
name                      AD2
descr
host-name                 host-name2.xsigo.com
port                      389
state                     up/up
error
oper-state-qual           normal
user-dn                   joe_user@xsigo.com
base-dn                   DC=XSIGO,DC=COM
server-mode               secondary
formal-user-dn            cn=joe_user,cn=users,dc=xsigo,dc=com
domain-represented-by     group
auth-type                 kerberos
```

```
kerberos-default-realm   XSIGO.COM
kerberos-default-domain  xsigo.com
kdc-host-name            host-name2.xsigo.com
kdc-port-num             88
-----------------------------------------------------------------
```

If the configuration is not correct, the state will be "up/down". The error field will show the corresponding warning so the administrator will know how to use `set ims ad-server` to resolve the problem. If the state is "indeterminate," it means the server-type of the IMS is not properly configured as `ldap_ad`, as the following example shows. The administrator can then use `set ims -server-type` to fix the problem:

Example: Set IMS to an AD Server

The following shows the command to set IMS to an AD server.

```
set ims -server-type=ldap_ad
show ims
cache-timeout          token-timeout          server-type
-----------------------------------------------------------------
240                       5                       ldap_ad
show ims -detail
-----------------------------------------------------------------
cache-timeout          240
token-timeout          5
server-type            ldap_ad
search-order           internalFirst
maps-to-root           root
num-of-servers         3
num-of-ad              2
num-of-sun             0
num-of-ibm             0
num-of-radius          1
-----------------------------------------------------------------
```

Example: Display All AD Server Configuration

```
show ims ad-server * -detail
------------------------------------------------------------------
name                        AD1
descr
host-name                   ad1.xsigo.com
port                        389
state                       up/up
error
user-dn                     user@xsigo.com
base-dn                     DC=XSIGO,DC=COM
server-mode                 primary
formal-user-dn
domain-represented-by       group
authentication-type         simple
kerberos-default-realm
kerberos-default-domain
kdc-host-name
kdc-port-num
------------------------------------------------------------------
1 record displayed
```

The chassis maintains a connection between IMS and the remote AD server. The “user-dn” is the user that initiates and maintains this connection. In the above example, the user is “user@xsigo.com”. The user must have at least read privileges since it queries all the role information. The “base-dn” is the tree-search range. You can reduce the search scope to increase the search speed, for example “DC=Users, DC=XSIGO, DC-COM”.

Using Role Group Mappings for AD/LDAP Users

For AD/LDAP IMS solutions, XgOS supports mapping individual AD groups to the pre-defined roles on the Oracle Fabric Interconnect. When the group is mapped, any user that is a member of the group can access the Oracle Fabric Interconnect through the group, and will receive the Oracle Fabric Interconnect privileges that are available through the role. The mapping occurs through a role group and a regular expression the selects against all the groups to which the user belongs.

Note – It is important to understand that regular expressions are used to match the user's groups against the role group mappings (for example, admin* is not the same as admin.*). Detailed explanation of regular expressions is outside the scope of this document. More information about regular expressions can be found on line.

The following role-groups are supported:

- administrators
- operators
- network
- storage
- servers
- noaccess

  The noaccess group is a special case in which the user that is mapped to this role cannot use the Oracle Fabric Interconnect or even display any information with it.

With role group mapping, you gain flexibility in how the AD groups interact with the Oracle Fabric Interconnect's RBAC model.

- You can use existing AD groups without the need to recreate them per specific guidelines to interact with the Oracle Fabric Interconnect. Instead, your existing AD groups can be mapped into the Oracle Fabric Interconnect's RBAC model.
- New groups can be created based on your department policies, then mapped into the Oracle Fabric Interconnect's RBAC model.

To determine the IMS roles that a user gets, a comparison occurs. The Oracle Fabric Interconnect matches against the AD groups configured, and the role group mapping to determine what RBAC role a user gets when that user logs in to the Oracle Fabric Interconnect. The match is made using a regular expression to find all the groups that might belong to a user. Then, the role is determined based on the precedence of the role group mappings. For details, see "Interaction Between Different Role Group Mappings" on page 261.

Because two group models exist for Xsigo RBAC using AD/LDAP (the previous version with "xg-" AD groups, and now role group mappings), there are some considerations for how the two models interoperate. Both models are supported, but for details, see "Interaction Between Existing Groups and Role Group Mappings" on page 261.

Note – Role group mappings are supported for AD/LDAP only. RADIUS and other IMS methods are not supported by this feature.

Interaction Between Existing Groups and Role Group Mappings

In previous versions of the XgOS IMS model, groups were required to be configured with an "xg-" prefix if users of those groups would be accessing the Oracle Fabric Interconnect. The previous model (groups with the "xg-" prefix) are still supported, so you do not need to delete and recreate those existing groups. However, with role group mappings, groups can be assigned to multiple roles, and as a result, the users in those groups can have multiple roles. If a user is in a group in both the previous "xg-" model and a role group mapping, the role group mapping is enforced. For example, assume the following:

- user Greg is configured in "xg-admins" on the AD server which maps to the administrator role.
- user Greg is also configured in the group "server-admins" which has a role group mapping to the "server" role on the Oracle Fabric Interconnect.

In this example, the role group mapping takes precedence. When Greg logs in to the Oracle Fabric Interconnect, he gets the server administrator role.

Interaction Between Different Role Group Mappings

When users are in an IMS system, and the Oracle Fabric Interconnect is integrated into that IMS system, the user logs in to the Oracle Fabric Interconnect based on one or more groups to which the user belongs. At the user's log in attempt, IMS is used to authenticate and if access is granted, the user's role-group is determined based on the list of groups to which the user belongs. At this point, specific rules are applied to determine which role the user is assigned. If multiple role group mappings are found for a user's groups, the determination of which group is used occurs as follows:

- If noaccess is present in the matched role groups, access is denied.
- If administrators is present, that role group is used.
- If storage, network or server is present, that role group is used.
- If operator is present, that role group is used.
- If no role group mapping matches for the user, the user's role is set to operator.

Making changes to a user (such as adding a new user, or switching the user to different groups), it is a best practice to flush the IMS cache to clear any stale information for the user, and refresh the user entry with the newest information. You can flush the IMS cache by issuing the `system flush ims` command.

Syntax

```
add ims role-group-mapping <name> <AD-group-name>
    [{admininstrators|network|no-access|server|storage|operator}]
set ims role-group-mapping <name> [-group=<name>] [-role=<name>]
    [-descr<string>]
show ims role-group-mapping [<name>]
remove ims role-group-mapping <name>
```

Parameter Description

Role group mapping commands take the following options:

Parameter	Description
<name>	Specifies the name of the role group mapping that you are adding. This name does not have to be the same as the AD group name that the mapping for.
<AD-group-name>	Specifies the name of the group that you are configuring on the AD/LDAP server. This is the actual name of a group on the AD server. You can use the exact name, or enter a regular expression. For example, if you have group domainadmins1, domainadmins2, domainadmins3, and domainadmins4, you can specify domainadmin.* instead of adding role group mappings for each individual AD group.
admininstrators|network|no-access|server|storage|operator	Is an optional choice list of roles that can be assigned.
-role=<name>	Is an optional argument that specifies the name of the xsigo role group that you are specifying for the mapped AD group when using the set ims role-group-mapping command.
-group=<name>	Is an optional argument for the AD group when using the set ims role-group-mapping command.
-descr=<string>	Is an optional argument that allows a description to be set for the role group mapping.

Example: Configure Role Group Mapping

For the following example, assume that the group pubs has been configured on the AD server, and you want to map it to the storage group on the Oracle Fabric Interconnect to allow configuration and management of vHBAs, LUN Masking, SAN QoS, and other elements related to storage.

When you are configuring a role group mapping, you can do so either of the following ways:

- Add the role mapping (add ims role-group-mapping) as one step, then use the set ims role-group-mapping command to set the group and role as a second step. This method is used for the examples in the following sections.
- Add the role mapping (add ims role-group-mapping) and group(s) as one step, then use the set ims role-group-mapping command to set the role as a second step.
- Add the mapping, group, and role all at once with the add ims role-group-mapping command.

Whichever way you choose to create the role group mapping, make sure that it has a name, one or more AD groups (or regular expressions for AD groups), and at least one XgOS role. The role group mapping must have all three of this parts to allow user access with the correct level of privileges.

▼ Configure a Role Group Mapping

To configure a role group mapping on the Oracle Fabric Interconnect, follow this procedure:

1. Create the mapping for the group.

```
add ims role-group-mapping publications
```

2. Assign the group mapping match expression and the role that is assigned when a match occurs.

```
set ims role-group-mapping publications -group=pubs -role=storage
```

3. (Optional) Set a description for the role group mapping.

```
set ims role-group-mapping publications -descr="For AD Group Publications"
```

4. Verify that the mapping is created correctly.

```
show ims role-group-mapping publications
name                group       role          descr
-------------------------------------------------------------
publications        pubs        storage       For AD Group Pubs
1 record displayed
```

Example: Add Role Group Mapping With a Regular Expression

By using a regular expression, you can simplify the creation of a role group mapping if many groups are similar and have the same role.

In the following example, a role group mapping will be created for the AD groups tech-marketing, tech-pubs, and tech-supports. A regular expression will be used in the role group mapping to allow matching against all of these groups. The role group mapping will set the role of "administrator" to any member of these groups.

▼ Add a Role Group Mapping

1. **Create a role group mapping.**

   For example:

```
add ims role-group-mapping mktingpubssupport
```

2. **Set the group using a regular expression, and set the role for the groups that match the regular expression.**

```
set ims role-group-mapping mktingpubssupport -group=tech.* -role=administrators
```

3. **Display the role group mapping to verify that it was added.**

```
show ims role-group-mapping mktingpubssupport
name                    group          role                    descr
-------------------------------------------------------------------
mktingpubssupport      tech.*         administrators
1 record displayed
```

Example: Remove a Role Group Mapping

For the following example, assume that you will be removing the role group mapping name publications. When the mapping is deleted, no matching occurs, and users in the group cannot access the Oracle Fabric Interconnect through the group served by the mapping. User can still access the Oracle Fabric Interconnect through other groups (if any) that are mapped.

```
remove ims role-group-mapping publications
```

When deleting the role group mapping the AD groups remain configured on the AD/LDAP server. The `remove ims role-group-mapping` command deletes the mapping only, and with the mapping gone, no regular expression matching occurs.

You can make edits to existing role group mapping through the `set ims role-group-mapping` command instead of deleting and recreating the mapping.

Using RADIUS as the IMS

RADIUS uses either CHAP or PAP (default) authentication. You can configure up to five servers. Each RADIUS server has equal preference (no ranking).

When using RADIUS as the IMS, use the following process:

1. Configure the AD server in XgOS as described in "Example: RADIUS IMS Server With Default Authentication" on page 266 or "Example: RADIUS IMS Server With CHAP Authentication" on page 266
2. Add RADIUS users to the configuration as described in "Configure RADIUS Users and Roles" on page 267.
3. Set the IMS to the configured server.
4. For an example, see "Example: Set IMS to a RADIUS Server" on page 268.

Syntax

```
add ims radius-server <server-name> <host[:port]> <user-name>
    -authentication-type={CHAP|PAP|default}
add ims radius-server <server-name> host[:port]> <user-name>
    -retries={<number>|default}
add ims radius-server <server-name> host[:port]> <user-name>
    -timeout={<number>|default}
add ims radius-user <name> <role>
set ims radius-server <name> <options>
set ims radius-user <name> [-descr] <roles>
remove ims radius-server <name>
remove ims radius-user [<name>|*]
show ims radius-server [<name>|*][-detail]
show ims radius-user [<name>|*]
```

Example: RADIUS IMS Server With Default Authentication

When configuring IMS to use a RADIUS server, you can use the following minimal command. This example accepts the defaults for the following:

- port (1812)
- authentication type (PAP)
- number of retries before failing to connect (3)
- time to wait before timing out the connection (3 seconds)

```
add ims radius-server RAD cesar joe
New password:
New password again:

Enter a secret:
New password:
New password again:
show ims radius-server RAD -detail
------------------------------------------------------------------
name       RAD
descr
host-name  cesar
port       1812
state      up/indeterminate
error
user-name  joe
auth-type  PAP
timeout    3
retries    3
------------------------------------------------------------------
1 record displayed
```

Example: RADIUS IMS Server With CHAP Authentication

The following example shows how to configure IMS as a RADIUS server using CHAP authentication and some custom option settings. This command does not use default option values.

```
add ims radius-server RAD2 cesar:200 joe -authentication-type=CHAP -retries=6
    -timeout=60
New password:
New password again:
```

```
Enter a secret:
New password:
New password again:
show ims radius-server RAD2 -detail
------------------------------------------------------------------
name       RAD2
descr
host-name  cesar
port       200
state      up/indeterminate
error
user-name  joe
auth-type  CHAP
timeout    60
retries    6
------------------------------------------------------------------
1 record displayed
```

Configure RADIUS Users and Roles

When using RADIUS for IMS, you configure the IMS and then add users through the XgOS command-line interface. For predefined user roles in XgOS, see the following table.

Example: Adding a RADIUS User

The following creates an account for Joe with read-only access to the chassis:

```
add ims radius-user Joe operators
show ims radius-user Joe
name     Joe
descr
roles    operators
```

Example: Changing a RADIUS User's Privileges

The following gives network administration privileges to the Joe account:

```
set ims radius-user Joe -roles=network
show ims radius-user Joe
name     Joe
descr
roles    network
```

Example: Set IMS to a RADIUS Server

The following shows the command to set IMS to a RADIUS server.

```
set ims -server-type=radius
show ims
cache-timeout          token-timeout          server-type
-------------------------------------------------------------------
240                        5                        radius
show ims -detail
-------------------------------------------------------------------
cache-timeout          240
token-timeout          5
server-type            radius
search-order           internalFirst
maps-to-root           root
num-of-servers         3
num-of-ad              0
num-of-sun             0
num-of-ibm             0
num-of-radius          1
-------------------------------------------------------------------
```

Example: Display all RADIUS Server Configurations

The following shows the command to display all RADIUS servers configurations.

```
show ims radius-server * -detail
-------------------------------------------------------------------
name                  RAD1
descr                 testtt
host-name             foo.xsigo.com
port                  1812
state                 up/up
err-message
user-name             user1
authentication-type   PAP
timeout               3
retries               3
-------------------------------------------------------------------
1 record displayed
```

Common IMS Operations

The examples in this section are the same for all IMS services, regardless of their type.

Example: Display the IMS Search Order

A search-order of "internalFirst" means that XgOS searches the local user database before searching your external IMS.

```
show ims -detail
------------------------------------------------------------------
cache-timeout          240
token-timeout          5
server-type            ldap_ad
search-order           internalFirst
maps-to-root           root
num-of-servers         2
num-of-ad-servers      1
num-of-sun-servers     0
num-of-ibm-servers     0
num-of-radius-servers              1
------------------------------------------------------------------
1 record displayed
```

In the example above, two servers are configured: one AD server and one RADIUS server. The local user database is checked first. Use `set ims -search-order` to change the IMS search order.

Example: Control Cached Authentication Data

Normally, IMS has to query the specified IMS server for role information when the user tries to log in for the first time. This kind of query can be resource intensive, especially for external IMS servers such as AD or RADIUS.

The chassis has a local cache to store role information for 240 minutes by default. The next time you log in within that time frame, IMS does not need to query the external IMS server again:

```
show ims -detail
------------------------------------------------------------------
cache-timeout          240
...
```

Configure `set ims -cache-timeout=0` to disable the cache. The external IMS will be queried every time someone logs in. Additionally the `system flush ims` command is available for "ADMIN" users to flush the cache immediately:

```
system flush ims
Identity Management System cache flushed
```

Setting the Shell Inactivity Timeout for Root User

The root file system of XgOS contains an inactivity timer for the root user. By default, when you log in to a Oracle Fabric Interconnect as root user (not admin), the Oracle Fabric Interconnect shell allows 60 minutes of inactivity. If no activity is detected within that time, the root user is logged out. This timer applies only to users logged in through the root account. The admin account is not affected.

The inactivity timer is customizable. To set the inactivity timer for the root login to a non-default value, you will edit a file in the Oracle Fabric Interconnect shell. After editing the file, you will need to log out, then log back in for the changes to take effect.

▼ Set Shell Inactivity Timeout

To set the shell inactivity timer for root user, follow this procedure:

1. **Log in to the Oracle Fabric Interconnect as the root user.**
2. **Remount the file system with read-write permissions.**

   For example:

```
remount . RW
Remounting / RW: OK
```

3. **Using vi or any other standard Linux-compliant file editor, display the contents of** `.bashrc`**.**

   For example:

```
vi .bashrc
# ~/.bashrc: executed by bash(1) for non-login shells.
export PS1='\h:\w\$ '
umask 022
# You may uncomment the following lines if you want `ls' to be colorized:
# export LS_OPTIONS='--color=auto'
# eval "`dircolors`"
# alias ls='ls $LS_OPTIONS'
# alias ll='ls $LS_OPTIONS -l'
# alias l='ls $LS_OPTIONS -lA'
#
# Some more alias to avoid making mistakes:
# alias rm='rm -i'
# alias cp='cp -i'
# alias mv='mv -i'
#
# Set user idle logout timeout to 60 min
# To disable it set it to 0 or comment out export command
#
TMOUT=3600
readwrite TMOUT
export TMOUT
```

4. **Modify the** `TMOUT=xxxx` **environment variable by entering a 4-digit number that sets the number of seconds that is allowed before the timeout expires and the root login is terminated.**

   Enter a 4-digit number between zero (which disables the timeout feature completely) and 9999 (which is 166.64 minutes).

5. **Write and quit the file to save the new timeout.**

6. **Remount the file system with read-write permissions.**

   For example:

```
pogrom:~# remount . RO
Remounting / RO: OK
```

7. **Log out of the current root user session (**`exit`**) on the Oracle Fabric Interconnect.**

   The new timeout value is applied to the next root user login and all others after that.

CHAPTER 16

Monitoring XgOS

This chapter provides reference and procedural information about monitoring XgOS and its managed objects. It contains the following sections:

- "SNMP" on page 273
- "Monitoring With Xsigo's SNMP MIBs" on page 276
- "Alarms" on page 290
- "Xsigo ProWatch Overview" on page 291
- "Displaying XgOS System Configuration" on page 301
- "Example: Display the Log Level" on page 306
- "Tracing End-to-End IB Path Continuity" on page 308

SNMP

XgOS supports SNMPv1, v2 and v3. The `get`, `getnext`, and `getbulk` operations are all supported. The `set` operations are not supported. Community strings are read-only.

Syntax

```
add snmp trap-dest <ip-addr>[:<port>] [-community=<string>] [-version=<string>]
remove snmp trap-dest <ip-addr>[:<port>] [-noconfirm]
set snmp -descr=<description>
set snmp -read-community=<string>
set snmp -sys-contact=<value>
set snmp -sys-location=<value>
set snmp -sys-name=<value>
show snmp
```

Note – If you are entering a description with internal blank spaces (for example Xsigo Systems) you must enclose the string in double quotes.

The default read-community string is “public”.

Example: SNMP Configuration

```
add snmp trap-dest <192.168.100.10:162>
set snmp -read-community=private
set snmp -descr="Xsigo Iowa"
set snmp -sys-contact=the_guy
set snmp -sys-location=Rack_C9
set snmp -sys-name=perfect-tech

show snmp
read-community descr sys-contact    sys-name     sys-loc  trap-destinations
-------------------------------------------------------------------
public         Xsigo iowa the_guy   perfect-tech Rack_C9   10.1.1.1:162
(private/SNMPv3)

1 record displayed
```

Configure Trap Destinations

To inform the Oracle Fabric Interconnect where to forward the traps, use the following command:

```
add snmp trap-dest <IPaddress>
```

Replace <*IPaddress*> with the IP address of the system where you are going to receive SNMP traps.

Note – Trap IDs are not sequential because they use the virtual resource id (VID). Removed virtual resources will leave gaps in the VID sequence.

MIB Support

The Xsigo MIB files are available on the Oracle Fabric Interconnect through the standard admin user login. Xsigo MIBs are available in `/opt/xsigo/xsigos/mibs`. To use the Xsigo MIBs, load all MIBs in this directory.

The following MIBs are supported:

- IF.mib is Xsigo Systems' implementation of the standard MIBs.
- XSIGO-IODIRECTOR-ENTITY-MIB is the Xsigo Systems enterprise entity MIB.
- XSIGO-COMM-MIB is the Xsigo Systems common object MIB.
- XSIGO-IODIRECTOR-TRAP-MIB defines the Xsigo Systems common trap objects. The traps themselves are in the entity MIB.

The Xsigo Enterprise MIB identifier is 24440.

IF-MIB

The following tables return valid values for SNMP queries:

- ifXTable—64-bit counters, object ID 1.3.6.1.2.1.31.1.1.1
- ifTable—32-bit counters, object ID 1.3.6.1.2.1.2.2.1

The following table lists statistic available in the ifXTable.

IF Attribute	vNIC	vHBA	ethPort	fcPort	ibPort
ifHCInOctets	y	y	y	y	y
ifHCInUcastPkts	y		y		
ifHCInBroadcastPkts	y				
ifHCOutOctets	y	y	y	y	y
ifHCOutUcastPkts			y		
ifHCOutBroadcastPkts	y				

The following table lists statistics available in the ifTable.

IF Attribute	vNIC	vHBA	ethPort	fcPort	ibPort
ifInDiscards	y		y		
ifOutDiscards					y
ifInErrors	y		y		y
ifOutErrors			y		y

XSIGO-IODIRECTOR-ENTITY-MIB

The following tables return valid values for SNMP queries:

Object Name	MIB Table	Object ID (OID)	Traps
Chassis	xsigoIoDirectorChassis	1.3.6.1.4.1.24440.3.1.1.1	Up, Down
IO Card	xsigoCardTable	1.3.6.1.4.1.24440.3.1.1.2	Inserted, Removed, Up, Down
Fan	xsigoFanTable	1.3.6.1.4.1.24440.3.1.1.3	Failed, Recovery
Temperature Probe	xsigoTemperatureProbeTable	1.3.6.1.4.1.24440.3.1.1.4	Alert, Recovery
Power Supply	xsigoPowerSupplyTable	1.3.6.1.4.1.24440.3.1.1.5	Failed, Recovery
IO Port (Ethernet and FC)	xsigoPortTable	1.3.6.1.4.1.24440.3.1.1.6	CapacityExceeded, CapacityRecovery
vNIC	xsigoVnicTable	1.3.6.1.4.1.24440.3.1.2.1	Created, Removed, Up, Down
vHBA	xsigoVhbaTable	1.3.6.1.4.1.24440.3.1.2.2	Created, Removed, Up, Down
Server Profile	xsigoServerProfileTable	1.3.6.1.4.1.24440.3.1.2.3	Created, Removed
Server Connection	xsigoServerConnectionTable	1.3.6.1.4.1.24440.3.1.2.4	Created, Removed, Failed, Recovery

Monitoring With Xsigo's SNMP MIBs

This section documents some of the more commonly used SNMP MIB objects you can monitor using SNMP Management software to check the Oracle Fabric Interconnect's operational status. Both the symbolic object name and its numeric Object ID (OID) are shown for each of the objects.

Note – If you need to integrate/compile the Xsigo MIBs, you can get them from the Oracle Xsigo Support Portal (`http://www.xsigo.com/support`).

Hardware Monitoring

The following chassis information can be monitored:

- Chassis operational state
- I/O module type and operational state
- I/O port operational state
- Fan operational state
- Power Supply (PSU) operational state

Chassis Status

The Oracle Fabric Interconnect chassis status should be in the `up state`, unless you have a failure in the system, such as a fan failure.

With symbolic object name:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 xsigoChassisOperState
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoChassisOperState.0 = INTEGER: up(2)
```

With numeric OID:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 -On xsigoChassisOperState
.1.3.6.1.4.1.24440.3.1.1.1.14.0 = INTEGER: up(2)
```

Issue a `show alarm` command should this value be in a state such as "partialFailure(28)."

I/O Module Status

Every I/O module should be in the `up state`, unless the Oracle Fabric Interconnect has just been rebooted and the I/O modules are still in the process of loading/booting the operating code.

With symbolic object name:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 xsigoCardType
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoCardType.10 = INTEGER:
nwEthernet10Port1GbCard(63)
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoCardType.12 = INTEGER:
sanFc2Port4GbLrCard(71)
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoCardType.14 = INTEGER:
nwEthernet4Port1GbCard(61)
```

With numeric OID:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 -On xsigoCardType
.1.3.6.1.4.1.24440.3.1.1.2.1.2.10 = INTEGER: nwEthernet10Port1GbCard(63)
.1.3.6.1.4.1.24440.3.1.1.2.1.2.12 = INTEGER: sanFc2Port4GbLrCard(71)
.1.3.6.1.4.1.24440.3.1.1.2.1.2.14 = INTEGER: nwEthernet4Port1GbCard(61)
```

With symbolic object name:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 xsigoCardOperState
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoCardOperState.10 = INTEGER: up(2)
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoCardOperState.12 = INTEGER: up(2)
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoCardOperState.14 = INTEGER: up(2)
```

With numeric OID:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 -On xsigoCardOperState
.1.3.6.1.4.1.24440.3.1.1.2.1.7.10 = INTEGER: up(2)
.1.3.6.1.4.1.24440.3.1.1.2.1.7.12 = INTEGER: up(2)
.1.3.6.1.4.1.24440.3.1.1.2.1.7.14 = INTEGER: up(2)
```

Physical I/O Port Status

Each physical I/O port actively used should be monitored to ensure connectivity.

With symbolic object name:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 xsigoPortLocation
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortLocation.1 = STRING: 10/1
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortLocation.2 = STRING: 10/2
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortLocation.3 = STRING: 10/3
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortLocation.4 = STRING: 10/4
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortLocation.5 = STRING: 10/5
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortLocation.6 = STRING: 10/6
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortLocation.7 = STRING: 10/7
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortLocation.8 = STRING: 10/8
```

```
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortLocation.9 = STRING: 10/9
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortLocation.10 = STRING: 10/10
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortLocation.11 = STRING: 12/1
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortLocation.12 = STRING: 12/2
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortLocation.13 = STRING: 14/1
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortLocation.14 = STRING: 14/2
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortLocation.15 = STRING: 14/3
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortLocation.16 = STRING: 14/4
```

With numeric OID:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 -On xsigoPortLocation
.1.3.6.1.4.1.24440.3.1.1.6.1.2.1 = STRING: 10/1
.1.3.6.1.4.1.24440.3.1.1.6.1.2.2 = STRING: 10/2
.1.3.6.1.4.1.24440.3.1.1.6.1.2.3 = STRING: 10/3
.1.3.6.1.4.1.24440.3.1.1.6.1.2.4 = STRING: 10/4
.1.3.6.1.4.1.24440.3.1.1.6.1.2.5 = STRING: 10/5
.1.3.6.1.4.1.24440.3.1.1.6.1.2.6 = STRING: 10/6
.1.3.6.1.4.1.24440.3.1.1.6.1.2.7 = STRING: 10/7
.1.3.6.1.4.1.24440.3.1.1.6.1.2.8 = STRING: 10/8
.1.3.6.1.4.1.24440.3.1.1.6.1.2.9 = STRING: 10/9
.1.3.6.1.4.1.24440.3.1.1.6.1.2.10 = STRING: 10/10
.1.3.6.1.4.1.24440.3.1.1.6.1.2.11 = STRING: 12/1
.1.3.6.1.4.1.24440.3.1.1.6.1.2.12 = STRING: 12/2
.1.3.6.1.4.1.24440.3.1.1.6.1.2.13 = STRING: 14/1
.1.3.6.1.4.1.24440.3.1.1.6.1.2.14 = STRING: 14/2
.1.3.6.1.4.1.24440.3.1.1.6.1.2.15 = STRING: 14/3
.1.3.6.1.4.1.24440.3.1.1.6.1.2.16 = STRING: 14/4
```

With symbolic object name:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 xsigoPortOperState
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortOperState.1 = INTEGER: up(2)
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortOperState.2 = INTEGER: down(3)
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortOperState.3 = INTEGER: up(2)
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortOperState.4 = INTEGER: up(2)
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortOperState.5 = INTEGER: down(3)
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortOperState.6 = INTEGER: down(3)
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortOperState.7 = INTEGER: down(3)
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortOperState.8 = INTEGER: down(3)
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortOperState.9 = INTEGER: down(3)
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortOperState.10 = INTEGER: down(3)
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortOperState.11 = INTEGER: up(2)
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortOperState.12 = INTEGER: down(3)
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortOperState.13 = INTEGER: down(3)
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortOperState.14 = INTEGER: down(3)
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortOperState.15 = INTEGER: down(3)
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPortOperState.16 = INTEGER: down(3)
```

With numeric OID:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 -On xsigoPortOperState
.1.3.6.1.4.1.24440.3.1.1.6.1.7.1 = INTEGER: up(2)
.1.3.6.1.4.1.24440.3.1.1.6.1.7.2 = INTEGER: down(3)
.1.3.6.1.4.1.24440.3.1.1.6.1.7.3 = INTEGER: up(2)
.1.3.6.1.4.1.24440.3.1.1.6.1.7.4 = INTEGER: up(2)
.1.3.6.1.4.1.24440.3.1.1.6.1.7.5 = INTEGER: down(3)
.1.3.6.1.4.1.24440.3.1.1.6.1.7.6 = INTEGER: down(3)
.1.3.6.1.4.1.24440.3.1.1.6.1.7.7 = INTEGER: down(3)
.1.3.6.1.4.1.24440.3.1.1.6.1.7.8 = INTEGER: down(3)
.1.3.6.1.4.1.24440.3.1.1.6.1.7.9 = INTEGER: down(3)
.1.3.6.1.4.1.24440.3.1.1.6.1.7.10 = INTEGER: down(3)
.1.3.6.1.4.1.24440.3.1.1.6.1.7.11 = INTEGER: up(2)
.1.3.6.1.4.1.24440.3.1.1.6.1.7.12 = INTEGER: down(3)
.1.3.6.1.4.1.24440.3.1.1.6.1.7.13 = INTEGER: down(3)
.1.3.6.1.4.1.24440.3.1.1.6.1.7.14 = INTEGER: down(3)
.1.3.6.1.4.1.24440.3.1.1.6.1.7.15 = INTEGER: down(3)
.1.3.6.1.4.1.24440.3.1.1.6.1.7.16 = INTEGER: down(3)
```

Fan Status

The Oracle Fabric Interconnect contains eight fan, and every fan can be monitored. The Oracle Fabric Interconnect can operated with up to 4 fan failures, but the Oracle Fabric Interconnect will shut down on the fifth fan failure after sending out SNMP traps and Syslog messages indicating the failure.

With symbolic object name:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 xsigoFanLocation
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoFanLocation.1 = STRING: Fan-1/1
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoFanLocation.2 = STRING: Fan-1/2
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoFanLocation.3 = STRING: Fan-2/1
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoFanLocation.4 = STRING: Fan-2/2
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoFanLocation.5 = STRING: Fan-3/1
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoFanLocation.6 = STRING: Fan-3/2
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoFanLocation.7 = STRING: Fan-4/1
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoFanLocation.8 = STRING: Fan-4/2
```

With numeric OID:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 -On xsigoFanLocation
.1.3.6.1.4.1.24440.3.1.1.3.1.2.1 = STRING: Fan-1/1
.1.3.6.1.4.1.24440.3.1.1.3.1.2.2 = STRING: Fan-1/2
.1.3.6.1.4.1.24440.3.1.1.3.1.2.3 = STRING: Fan-2/1
.1.3.6.1.4.1.24440.3.1.1.3.1.2.4 = STRING: Fan-2/2
.1.3.6.1.4.1.24440.3.1.1.3.1.2.5 = STRING: Fan-3/1
```

```
.1.3.6.1.4.1.24440.3.1.1.3.1.2.6 = STRING: Fan-3/2
.1.3.6.1.4.1.24440.3.1.1.3.1.2.7 = STRING: Fan-4/1
.1.3.6.1.4.1.24440.3.1.1.3.1.2.8 = STRING: Fan-4/2
```

With symbolic object name:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 xsigoFanOperState
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoFanOperState.1 = INTEGER: up(2)
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoFanOperState.2 = INTEGER: up(2)
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoFanOperState.3 = INTEGER: up(2)
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoFanOperState.4 = INTEGER: up(2)
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoFanOperState.5 = INTEGER: up(2)
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoFanOperState.6 = INTEGER: up(2)
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoFanOperState.7 = INTEGER: up(2)
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoFanOperState.8 = INTEGER: up(2)
```

With numeric OID:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 -On xsigoFanOperState
.1.3.6.1.4.1.24440.3.1.1.3.1.8.1 = INTEGER: up(2)
.1.3.6.1.4.1.24440.3.1.1.3.1.8.2 = INTEGER: up(2)
.1.3.6.1.4.1.24440.3.1.1.3.1.8.3 = INTEGER: up(2)
.1.3.6.1.4.1.24440.3.1.1.3.1.8.4 = INTEGER: up(2)
.1.3.6.1.4.1.24440.3.1.1.3.1.8.5 = INTEGER: up(2)
.1.3.6.1.4.1.24440.3.1.1.3.1.8.6 = INTEGER: up(2)
.1.3.6.1.4.1.24440.3.1.1.3.1.8.7 = INTEGER: up(2)
.1.3.6.1.4.1.24440.3.1.1.3.1.8.8 = INTEGER: up(2)
```

Temperature Sensors

The Oracle Fabric Interconnect contains multiple intra-chassis temperature sensors. If a temperature reading on a sensor approaches its maximum value, the Oracle Fabric Interconnect sends out an SNMP trap message indicating that the temperature is getting too high. If the temperature still continues to increase, then the Oracle Fabric Interconnect shutdown one or more I/O modules, or the entire chassis depending on the temperature sensor location.

With symbolic object name:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 xsigoTemperatureProbeTable
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeIndex.1 = INTEGER: 1
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeIndex.2 = INTEGER: 2
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeIndex.3 = INTEGER: 3
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeIndex.4 = INTEGER: 4
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeIndex.5 = INTEGER: 5
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeIndex.6 = INTEGER: 6
```

```
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeIndex.7 = INTEGER: 7
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeIndex.8 = INTEGER: 8
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeIndex.9 = INTEGER: 9
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeIndex.10 = INTEGER: 10
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeIndex.11 = INTEGER: 11
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeIndex.12 = INTEGER: 12
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeIndex.13 = INTEGER: 13
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeIndex.53 = INTEGER: 53
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeIndex.54 = INTEGER: 54
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeName.1 = STRING:
scpCard-hd_temp_current
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeName.2 = STRING:
scpCard-hd_temp_minimum
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeName.3 = STRING:
scpCard-hd_temp_maximum
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeName.4 = STRING:
frontPanelCard-temp_in
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeName.5 = STRING:
frontPanelCard-temp_out
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeName.6 = STRING: temp_in
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeName.7 = STRING: temp_mid
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeName.8 = STRING: temp_out
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeName.9 = STRING:
fanController-temp_out
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeName.10 = STRING:
nwEthernet4Port1GbCard-temp_in
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeName.11 = STRING:
nwEthernet4Port1GbCard-temp_out
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeName.12 = STRING:
sanFc2Port4GbLrCard-temp_in
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeName.13 = STRING:
sanFc2Port4GbLrCard-temp_out
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeName.53 = STRING:
nwEthernet10Port1GbCard-temp_in
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeName.54 = STRING:
nwEthernet10Port1GbCard-temp_out
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeLocation.1 = STRING:
fabricCard
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeLocation.2 = STRING:
fabricCard
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeLocation.3 = STRING:
fabricCard
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeLocation.4 = STRING:
fabricCard
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeLocation.5 = STRING:
fabricCard
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeLocation.6 = STRING:
fabricCard
```

```
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeLocation.7 = STRING:
fabricCard
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeLocation.8 = STRING:
fabricCard
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeLocation.9 = STRING:
fabricCard
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeLocation.10 = STRING: IO Card
Slot - 14
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeLocation.11 = STRING: IO Card
Slot - 14
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeLocation.12 = STRING: IO Card
Slot - 12
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeLocation.13 = STRING: IO Card
Slot - 12
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeLocation.53 = STRING: IO Card
Slot - 10
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeLocation.54 = STRING: IO Card
Slot - 10
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeActValue.1 = STRING: 26
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeActValue.2 = STRING: 14
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeActValue.3 = STRING: 49
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeActValue.4 = STRING: 24
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeActValue.5 = STRING: 24
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeActValue.6 = STRING: 28
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeActValue.7 = STRING: 29
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeActValue.8 = STRING: 30
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeActValue.9 = STRING: 24
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeActValue.10 = STRING: 27
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeActValue.11 = STRING: 37
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeActValue.12 = STRING: 27
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeActValue.13 = STRING: 33
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeActValue.53 = STRING: 29
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeActValue.54 = STRING: 54
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeMaxValue.1 = STRING: 55
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeMaxValue.2 = STRING: 55
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeMaxValue.3 = STRING: 55
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeMaxValue.4 = STRING: 65
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeMaxValue.5 = STRING: 65
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeMaxValue.6 = STRING: 65
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeMaxValue.7 = STRING: 65
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeMaxValue.8 = STRING: 65
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeMaxValue.9 = STRING: 65
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeMaxValue.10 = STRING: 65
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeMaxValue.11 = STRING: 65
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeMaxValue.12 = STRING: 65
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeMaxValue.13 = STRING: 65
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeMaxValue.53 = STRING: 65
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoTemperatureProbeMaxValue.54 = STRING: 75
```

With numeric OID:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 -On xsigoTemperatureProbeTable
.1.3.6.1.4.1.24440.3.1.1.4.1.1.1 = INTEGER: 1
.1.3.6.1.4.1.24440.3.1.1.4.1.1.2 = INTEGER: 2
.1.3.6.1.4.1.24440.3.1.1.4.1.1.3 = INTEGER: 3
.1.3.6.1.4.1.24440.3.1.1.4.1.1.4 = INTEGER: 4
.1.3.6.1.4.1.24440.3.1.1.4.1.1.5 = INTEGER: 5
.1.3.6.1.4.1.24440.3.1.1.4.1.1.6 = INTEGER: 6
.1.3.6.1.4.1.24440.3.1.1.4.1.1.7 = INTEGER: 7
.1.3.6.1.4.1.24440.3.1.1.4.1.1.8 = INTEGER: 8
.1.3.6.1.4.1.24440.3.1.1.4.1.1.9 = INTEGER: 9
.1.3.6.1.4.1.24440.3.1.1.4.1.1.10 = INTEGER: 10
.1.3.6.1.4.1.24440.3.1.1.4.1.1.11 = INTEGER: 11
.1.3.6.1.4.1.24440.3.1.1.4.1.1.12 = INTEGER: 12
.1.3.6.1.4.1.24440.3.1.1.4.1.1.13 = INTEGER: 13
.1.3.6.1.4.1.24440.3.1.1.4.1.1.53 = INTEGER: 53
.1.3.6.1.4.1.24440.3.1.1.4.1.1.54 = INTEGER: 54
.1.3.6.1.4.1.24440.3.1.1.4.1.2.1 = STRING: scpCard-hd_temp_current
.1.3.6.1.4.1.24440.3.1.1.4.1.2.2 = STRING: scpCard-hd_temp_minimum
.1.3.6.1.4.1.24440.3.1.1.4.1.2.3 = STRING: scpCard-hd_temp_maximum
.1.3.6.1.4.1.24440.3.1.1.4.1.2.4 = STRING: frontPanelCard-temp_in
.1.3.6.1.4.1.24440.3.1.1.4.1.2.5 = STRING: frontPanelCard-temp_out
.1.3.6.1.4.1.24440.3.1.1.4.1.2.6 = STRING: temp_in
.1.3.6.1.4.1.24440.3.1.1.4.1.2.7 = STRING: temp_mid
.1.3.6.1.4.1.24440.3.1.1.4.1.2.8 = STRING: temp_out
.1.3.6.1.4.1.24440.3.1.1.4.1.2.9 = STRING: fanController-temp_out
.1.3.6.1.4.1.24440.3.1.1.4.1.2.10 = STRING: nwEthernet4Port1GbCard-temp_in
.1.3.6.1.4.1.24440.3.1.1.4.1.2.11 = STRING: nwEthernet4Port1GbCard-temp_out
.1.3.6.1.4.1.24440.3.1.1.4.1.2.12 = STRING: sanFc2Port4GbLrCard-temp_in
.1.3.6.1.4.1.24440.3.1.1.4.1.2.13 = STRING: sanFc2Port4GbLrCard-temp_out
.1.3.6.1.4.1.24440.3.1.1.4.1.2.53 = STRING: nwEthernet10Port1GbCard-temp_in
.1.3.6.1.4.1.24440.3.1.1.4.1.2.54 = STRING: nwEthernet10Port1GbCard-temp_out
.1.3.6.1.4.1.24440.3.1.1.4.1.3.1 = STRING: fabricCard
.1.3.6.1.4.1.24440.3.1.1.4.1.3.2 = STRING: fabricCard
.1.3.6.1.4.1.24440.3.1.1.4.1.3.3 = STRING: fabricCard
.1.3.6.1.4.1.24440.3.1.1.4.1.3.4 = STRING: fabricCard
.1.3.6.1.4.1.24440.3.1.1.4.1.3.5 = STRING: fabricCard
.1.3.6.1.4.1.24440.3.1.1.4.1.3.6 = STRING: fabricCard
.1.3.6.1.4.1.24440.3.1.1.4.1.3.7 = STRING: fabricCard
.1.3.6.1.4.1.24440.3.1.1.4.1.3.8 = STRING: fabricCard
.1.3.6.1.4.1.24440.3.1.1.4.1.3.9 = STRING: fabricCard
.1.3.6.1.4.1.24440.3.1.1.4.1.3.10 = STRING: IO Card Slot - 14
.1.3.6.1.4.1.24440.3.1.1.4.1.3.11 = STRING: IO Card Slot - 14
.1.3.6.1.4.1.24440.3.1.1.4.1.3.12 = STRING: IO Card Slot - 12
.1.3.6.1.4.1.24440.3.1.1.4.1.3.13 = STRING: IO Card Slot - 12
.1.3.6.1.4.1.24440.3.1.1.4.1.3.53 = STRING: IO Card Slot - 10
.1.3.6.1.4.1.24440.3.1.1.4.1.3.54 = STRING: IO Card Slot - 10
.1.3.6.1.4.1.24440.3.1.1.4.1.4.1 = STRING: 26
```

```
.1.3.6.1.4.1.24440.3.1.1.4.1.4.2 = STRING: 14
.1.3.6.1.4.1.24440.3.1.1.4.1.4.3 = STRING: 49
.1.3.6.1.4.1.24440.3.1.1.4.1.4.4 = STRING: 24
.1.3.6.1.4.1.24440.3.1.1.4.1.4.5 = STRING: 24
.1.3.6.1.4.1.24440.3.1.1.4.1.4.6 = STRING: 28
.1.3.6.1.4.1.24440.3.1.1.4.1.4.7 = STRING: 29
.1.3.6.1.4.1.24440.3.1.1.4.1.4.8 = STRING: 30
.1.3.6.1.4.1.24440.3.1.1.4.1.4.9 = STRING: 24
.1.3.6.1.4.1.24440.3.1.1.4.1.4.10 = STRING: 28
.1.3.6.1.4.1.24440.3.1.1.4.1.4.11 = STRING: 37
.1.3.6.1.4.1.24440.3.1.1.4.1.4.12 = STRING: 27
.1.3.6.1.4.1.24440.3.1.1.4.1.4.13 = STRING: 33
.1.3.6.1.4.1.24440.3.1.1.4.1.4.53 = STRING: 29
.1.3.6.1.4.1.24440.3.1.1.4.1.4.54 = STRING: 54
.1.3.6.1.4.1.24440.3.1.1.4.1.5.1 = STRING: 55
.1.3.6.1.4.1.24440.3.1.1.4.1.5.2 = STRING: 55
.1.3.6.1.4.1.24440.3.1.1.4.1.5.3 = STRING: 55
.1.3.6.1.4.1.24440.3.1.1.4.1.5.4 = STRING: 65
.1.3.6.1.4.1.24440.3.1.1.4.1.5.5 = STRING: 65
.1.3.6.1.4.1.24440.3.1.1.4.1.5.6 = STRING: 65
.1.3.6.1.4.1.24440.3.1.1.4.1.5.7 = STRING: 65
.1.3.6.1.4.1.24440.3.1.1.4.1.5.8 = STRING: 65
.1.3.6.1.4.1.24440.3.1.1.4.1.5.9 = STRING: 65
.1.3.6.1.4.1.24440.3.1.1.4.1.5.10 = STRING: 65
.1.3.6.1.4.1.24440.3.1.1.4.1.5.11 = STRING: 65
.1.3.6.1.4.1.24440.3.1.1.4.1.5.12 = STRING: 65
.1.3.6.1.4.1.24440.3.1.1.4.1.5.13 = STRING: 65
.1.3.6.1.4.1.24440.3.1.1.4.1.5.53 = STRING: 65
.1.3.6.1.4.1.24440.3.1.1.4.1.5.54 = STRING: 75
```

Power Supply (PSU) Status

The Oracle Fabric Interconnect is capable of operating on only one power supply unit (PSU) even for a fully loaded chassis. If one PSU fails, you can replace the failed unit without bringing down the system.

With symbolic object name:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 xsigoPowerSupplyName
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPowerSupplyName.1 = STRING: PowerSupply-1
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPowerSupplyName.2 = STRING: PowerSupply-2
```

With numeric OID:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 -On xsigoPowerSupplyName
.1.3.6.1.4.1.24440.3.1.1.5.1.2.1 = STRING: PowerSupply-1
.1.3.6.1.4.1.24440.3.1.1.5.1.2.2 = STRING: PowerSupply-2
```

With symbolic object name:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 xsigoPowerSupplyOperState
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPowerSupplyOperState.1 = INTEGER: failed(4)
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoPowerSupplyOperState.2 = INTEGER: up(2)
```

With numeric OID:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 -On xsigoPowerSupplyOperState
.1.3.6.1.4.1.24440.3.1.1.5.1.7.1 = INTEGER: failed(4)
.1.3.6.1.4.1.24440.3.1.1.5.1.7.2 = INTEGER: up(2)
```

System Status

You can monitor system information about the Oracle Fabric Interconnect as well as the system control processor (SCP).

Basic System Information

- System name, with the symbolic object name:

```
$ snmpwalk -c public -v2c 192.168.10.100 sysName.0
SNMPv2-MIB::sysName.0 = STRING: Xsigo F1-15-1
```

- System name, with numeric OID:

```
$ snmpwalk -c public -v2c 192.168.10.100 -On sysName.0
.1.3.6.1.2.1.1.5.0 = STRING: Xsigo F1-15-1
```

- System uptime, with the symbolic object name:

```
$ snmpwalk -c public -v2c 192.168.10.100 sysUpTime.0
DISMAN-EVENT-MIB::sysUpTimeInstance = Timeticks: (157035) 0:26:10.35
```

- System uptime, with numeric OID:

```
$ snmpwalk -c public -v2c 192.168.10.100 -On sysUpTime.0
.1.3.6.1.2.1.1.3.0 = Timeticks: (160549) 0:26:45.49
```

System Controller (SCP) Status

You can monitor utilization of the CPU on the System Control Processor (SCP) and utilization of memory on the SCP:

- SCP CPU usage, with the symbolic object name:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 xsigoChassisCpuUsage
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoChassisCpuUsage.0 = STRING: 2.50223
```

- SCP CPU usage, with the numeric OID:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 -On xsigoChassisCpuUsage
.1.3.6.1.4.1.24440.3.1.1.1.15.0 = STRING: 2.50223
```

- SCP memory usage, with the symbolic object name:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 xsigoChassisMemoryUsage
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoChassisMemoryUsage.0 = STRING: 23.2385
```

- SCP memory usage, with the numeric OID:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 -On xsigoChassisMemoryUsage
.1.3.6.1.4.1.24440.3.1.1.1.16.0 = STRING: 23.2385
```

Virtual I/O Interfaces

You can list OVN virtual interfaces and display the status of each virtual interface.

Listing Virtual Interfaces

All configured virtual interfaces will be listed.

With symbolic object name:

```
$ snmpwalk -c public -v2c 192.168.10.100 ifDescr
IF-MIB::ifDescr.3 = STRING: vnic1.webserver-1
IF-MIB::ifDescr.4 = STRING: vnic2.webserver-1
IF-MIB::ifDescr.5 = STRING: vhba1.webserver-1
```

With numeric OID:

```
$ snmpwalk -c public -v2c 192.168.10.100 -On ifDescr
.1.3.6.1.2.1.2.2.1.2.3 = STRING: vnic1.webserver-1
.1.3.6.1.2.1.2.2.1.2.4 = STRING: vnic2.webserver-1
.1.3.6.1.2.1.2.2.1.2.5 = STRING: vhba1.webserver-1
```

Virtual Interface Status

All virtual interfaces should be `up`.

With symbolic object name:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 ifOperStatus
IF-MIB::ifOperStatus.3 = INTEGER: up(1)
IF-MIB::ifOperStatus.4 = INTEGER: up(1)
IF-MIB::ifOperStatus.5 = INTEGER: down(2)
```

With numeric OID:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 -On ifOperStatus
.1.3.6.1.2.1.2.2.1.8.3 = INTEGER: up(1)
.1.3.6.1.2.1.2.2.1.8.4 = INTEGER: up(1)
.1.3.6.1.2.1.2.2.1.8.5 = INTEGER: down(2)
```

Check the physical I/O port status, the I/O module status, and the server profile status if a virtual interface is in a `down` state.

Traffic Counters

You can monitor traffic counters for both input and output octets.

Input and Output Traffic Counters

Both input and output traffic counters can be obtained via SNMP.

Note – The input and output octets counters are 64-bit counters. As a result, some SNMP management software might not display them properly if the software supports only 32-bit counters.

With symbolic object name:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 ifHCInOctets
IF-MIB::ifHCInOctets.3 = Counter64: 11783
IF-MIB::ifHCInOctets.4 = Counter64: 926
IF-MIB::ifHCInOctets.5 = Counter64: 0
```

With numeric OID:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 -On ifHCInOctets
.1.3.6.1.2.1.31.1.1.1.6.3 = Counter64: 12263
.1.3.6.1.2.1.31.1.1.1.6.4 = Counter64: 926
.1.3.6.1.2.1.31.1.1.1.6.5 = Counter64: 0
```

With symbolic object name:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 ifHCOutOctets
IF-MIB::ifHCOutOctets.3 = Counter64: 16947
IF-MIB::ifHCOutOctets.4 = Counter64: 10929
IF-MIB::ifHCOutOctets.5 = Counter64: 0
```

With numeric OID:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 -On ifHCOutOctets
.1.3.6.1.2.1.31.1.1.1.10.3 = Counter64: 16947
.1.3.6.1.2.1.31.1.1.1.10.4 = Counter64: 10929
.1.3.6.1.2.1.31.1.1.1.10.5 = Counter64: 0
```

Server Profile Status

A server profile should be in the `up` state, unless it has not yet been associated with a physical server, or the Oracle Fabric Interconnect is still in the process of booting.

With symbolic object name:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 xsigoServerProfileTable
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoServerProfileIndex.34 = INTEGER: 34
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoServerProfileName.34 = STRING: webserver-1
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoServerProfileDefaultGW.34 = STRING:
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoServerProfileNumConnections.34 = INTEGER: 1
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoServerProfileAdminState.34 = INTEGER: up(1)
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoServerProfileOperState.34 = INTEGER: up(2)
XSIGO-IODIRECTOR-ENTITY-MIB::xsigoServerProfileTableEntry.7.34 = STRING:
"RHEL52-IBM-x3455"
```

With numeric OID:

```
$ snmpwalk -c public -v2c -mALL 192.168.10.100 -On xsigoServerProfileTable
.1.3.6.1.4.1.24440.3.1.2.3.1.1.34 = INTEGER: 34
.1.3.6.1.4.1.24440.3.1.2.3.1.2.34 = STRING: webserver-1
.1.3.6.1.4.1.24440.3.1.2.3.1.3.34 = STRING:
.1.3.6.1.4.1.24440.3.1.2.3.1.4.34 = INTEGER: 1
.1.3.6.1.4.1.24440.3.1.2.3.1.5.34 = INTEGER: up(1)
.1.3.6.1.4.1.24440.3.1.2.3.1.6.34 = INTEGER: up(2)
.1.3.6.1.4.1.24440.3.1.2.3.1.7.34 = STRING: "RHEL52-IBM-x3455"
```

Alarms

Issue `show alarms` to display alarms in the system database.

Syntax

```
show alarms
```

Example

```
show alarms
time                     type   name      severity  cause       descr
------------------------------------------------------------------------------
2007-08-16 22:09:54.439 server vserver1  warning   termination Unspecified no
                                                               physical
                                                               compute
                                                               resource
                                                               provisioned.
```

Alarms have a severity of info, warning, minor, major, or critical. These categories align with the definitions used in ITU-T X.733E (Alarm Reporting Function).

You can configure Xsigo ProWatch to send information about your system and its operations to Oracle Technical Support whenever a major or critical alarm occurs. For instructions about configuring ProWatch, see "Xsigo ProWatch Overview" on page 291.

Xsigo ProWatch Overview

The Xsigo ProWatch feature supports periodically transmitting the contents of log files and the output of the `show tech-support` command, to Oracle Technical Support. This enables Oracle Technical Support to proactively look for and diagnose potential problems without requiring you to collect data, package it, and transmit it Oracle.

The information collected is only from `show tech-support` and system logs. No sensitive customer data is gathered and transmitted to Oracle. To ensure that private information is kept safe, the Xsigo ProWatch feature provides ways to:

- send a copy of the information to an internal website for auditing purposes
- remove private data, such as IP addresses, from the data.

Also, the data is transmitted in an encrypted form so that it cannot easily be read.

ProWatch Modes

Xsigo ProWatch operates in the following modes:

- On-demand, which enables you to initiate a Xsigo ProWatch data transmission at any time as long as the Xsigo ProWatch feature is configured
- Periodic, which enables the transmission of Xsigo ProWatch data at regularly scheduled intervals. This mode is the main use case to proactively transmit data
- When major or critical alarms occur

These modes are not mutually exclusive. As a result, you can send on-demand Xsigo ProWatch data on an as-needed basis without disrupting any scheduled transmissions. However, Oracle recommends that you do not send an on-demand transmission at the same time as a scheduled periodic transmission.

ProWatch Transmission Schedules

When you configure ProWatch, you set a frequency at which the feature monitors data. When the period expires or the event occurs, the data is transmitted. ProWatch data can be configured to transmit at any of the following triggers:

- daily
- weekly (this is the default setting)
- monthly

- when major or critical alarms occur

When you configure periodic transmission of data, the Oracle Fabric Interconnect starts a timer when any of the following events occurs:

- the Xsigo ProWatch facility is enabled
- XgOS starts because of a chassis reboot
- the daily, weekly, or monthly interval is changed.

The frequency is calculated from that time at which the timer starts. The result is the next scheduled transmission of data. For example, if the Xsigo ProWatch feature is enabled at 6:00 p.m. on a Tuesday, and the frequency is set to “weekly”, Xsigo ProWatch data is transmitted at 6:00 p.m. on the following Tuesday and every Tuesday thereafter.

Note – Xsigo ProWatch does not transmit a baseline the first time it enabled. However, if you want to transmit data soon after Xsigo ProWatch is initially configured, you can initiate an on-demand transmission.

ProWatch also has a snooze feature, which allows you to leave the original ProWatch configuration intact, but temporarily delay the transmission of phone home messages on an as-needed basis. When the snooze interval completes, the original phone home schedule resumes as normal.

HTTP Proxy Support

Xsigo ProWatch data is transmitted through HTTP (not HTTPS). The Xsigo ProWatch facility supports HTTP proxy servers through software commands that configure:

- proxy host name or IP address
- an optional proxy port, which can be appended to the proxy host name or IP address.
- an optional proxy user name
- an optional proxy password, which is clear text.

ProWatch Command Syntax

```
system phone-home [-noconfirm]
set system phone-home disable
set system phone-home enable
set system phone-home noproxy
set system phone-home proxy <hostname> {<port-number>|default}
    {[<user-name>] [<password>]}
set system phone-home snooze <minutes>m|<hours>h|<days>d|off
set system phone-home -contact-email-address=<string>|none
set system phone-home -contact-phone-numbers=<string>|none
set system phone-home -copy-url=<string>|none
set system phone-home -customer-name=<string>
set system phone-home -frequency={daily|monthly|weekly|alarms_only}
set system phone-home -notify={default|false|true}
set system phone-home -send-alarms={default|false|true}
set system phone-home -strip-private={default|false|true}
show system phone-home
set server-profile {*|<name>} -phone-home-enabled=[default] [true] [false]
```

ProWatch Parameter Descriptions

As always when working with the CLI, enclose values in quotation marks if they include spaces or equals signs (=).

Parameter	Description
`default`	Sets the parameter to its default value: • For the `proxy` option, default causes Xsigo ProWatch communication to occur on port 3128. • For the `-notify` qualifier, default causes no notification when Xsigo ProWatch communication occurs. • For the `-strip-private` qualifier, default causes the IP addresses to be removed from the Xsigo ProWatch information and replaced with a <privip:x> string—for example, <privip:1> <privip:2> and so on.
`<hostname>`	Specifies the hostname or IP address for the proxy server that will be sending ProWatch information.
`<port-number>`	For the `proxy` option, enables specifying a particular TCP port on which the Xsigo ProWatch information is transmitted. You can specify `default`, which sets the TCP port to 3128. Valid port numbers are in the range of 80 to 65535.

Parameter	Description
<minutes>m|<hours>h|<days>d|off	Sets the timer for the phone snooze period, or disables an in-progress snooze timer. When the snooze timer expires, or is manually disabled with the off option, then the Phone Home schedule resumes based on its configuration.
<string>	Specifies an alphanumeric text string for different types of ProWatch parameters: • For the -contact-email-address qualifier, this is a free format string that specifies the email address of someone at the customer site that Oracle can contact—typically the Oracle Fabric Interconnect administrator. • For the -contact-phone-numbers qualifier, this is a free-format string that specifies the phone number(s) of someone at the customer site that Oracle can contact—typically the Oracle Fabric Interconnect administrator. If the customer-phone-number strings will contain internal blank spaces, you must enclose the phone numbers in double quotes (for example, "800 234 5678"). Also, you can specify multiple phone numbers in a comma-separated list, but the commas must be enclosed in the double quotes. For example, "800 234 5678, 800 234 8000" is valid, but "800 234 5678", "800 234 8000" is not. • For the -copy-url qualifier, the string specifies the URL and port that receives a copy of the Xsigo ProWatch data when it is sent. For example: http://barkely.xyz.com:8080. • For the -customer-name qualifier, the string specifies the name of the customer. If the customer name contains an internal blank space (for example, Company XYZ), you must enclose the customer name in double quotes (for example, "XYZ Incorporated").
none	Clears any text string configured for -contact-email-address, -copy-url, -contact-phone-numbers, or -customer-name parameters.

Optional Qualifiers

Parameter	Description
`-contact-email-address`	Specifies an email address for a person who Oracle technical support can contact if it appears that the Oracle Fabric Interconnect needs attention.
`-contact-phone-numbers`	Specifies one or more comma-separated telephone numbers for Oracle technical support to contact if it appears that the Oracle Fabric Interconnect needs attention.
`-copy-url`	Specifies a URL internal to your data center where the ProWatch feature can place a copy of the data for audit. When data is copied to your internal location, it is not encrypted.
`-customer-name`	Specifies the name of the Oracle customer. Enter a name that identifies your account with Oracle. Typically, this is your company's name.
`-frequency`	Specifies the interval between ProWatch report. One of: • daily • weekly (this is the default setting) • monthly • when major or critical alarms occur
`-noconfirm`	Is an optional qualifier that controls whether a confirmation message is displayed when you use the Xsigo ProWatch in on-demand mode. Enter true or false.
`-notify`	Specifies whether Oracle technical support should contact persons in the `-contact-email-address` and `-contact-phone-numbers` values when problems are detected. Enter true or false.
`-send-alarms`	Specifies whether to send major alarms to Oracle technical support. For details of this modifier, see "Sending ProWatch Data When Alarms Occur" on page 296. Enter true or false.
`-strip-private`	Specifies whether to strip company private data, such as IP addresses, from the report that is sent. By default, this option is set to true. Enter true or false.
`set server-profile {*|<name>} -phone-home-enabled`	Allows enabling and disabling ProWatch for individual Server Profiles. The global state of ProWatch is not affected when ProWatch is enabled, disabled, or reset to default on a per-Server Profile basis.

Internet Connection Requirement

The Xsigo ProWatch data is transmitted as an HTTP POST transfer. For the transfer to be successful, the Oracle Fabric Interconnect must be able to open an outgoing

port to connect to the Internet. Make sure that the Oracle Fabric Interconnect can connect to:

`http://phone-home.xsigo.com:6522/`

Xsigo ProWatch uses an HTTP POST transfer and data is encrypted while it is on the public Internet.

Sending ProWatch Data When Alarms Occur

Major alarms include things like an I/O card not coming up or a server failing to connect. All major alarms can negatively affect the data center's I/O. If you use ProWatch to send information about alarms to Oracle, be aware of the following:

- If a major alarm is cleared within five minutes of being raised, no report is sent.
- If multiple major alarms are raised within five minutes, only one report containing all the alarms is sent.

If you want to send reports only when major alarms occur, set the `-frequency` option to `alarms_only`. If you want to send both periodic reports and reports when alarms occur, set the `-frequency` option to the desired period: daily, weekly, or monthly. Then use the `-send_alarms=true` option to also send reports when major alarms occur.

Configuring ProWatch

You might have enabled ProWatch during the initial setup of your Oracle Fabric Interconnect. If you answered `yes` to the following question:

```
Do you want this Director to send diagnostic data to Xsigo periodically?
```

while running the Configuration Wizard, you have ProWatch enabled with the default values listed in "ProWatch Parameter Descriptions" on page 293.

To discover whether you have ProWatch enabled, use the following command:

```
show system phone-home
```

```
enabled freq   next notify strip alarm name email phone copy p-host p-user
-------------------------------------------------------------------------------
true    weekly -    no     yes    yes
```

The following section documents how to configure Xsigo ProWatch with your specific parameter values. Before performing the configuration process, you will find it helpful to do the following:

- Determine if you will want to keep a copy of the information sent.
- Determine if you will want to use a proxy when sending the Xsigo ProWatch information.
- Determine if you want Oracle to contact you if we discover a potential problem.
- Gather email accounts and phone numbers of contacts within your company.
- Determine how often you want Xsigo ProWatch information transmitted.
- Determine whether you want additional reports sent when major and critical alarms occur.

▼ Configure ProWatch

1. **Determine whether you are configuring a proxy:**

   a. **If not, skip to** Step 2**.**

   b. **If so, configure the proxy information.**

      For example, to use port 4000 on a proxy named “shaggy” at a company called “xyz.com” and set the username and password to “proxyuser1” and “passproxy” respectively:

```
set system phone-home proxy shaggy.xyx.com 4000 proxyuser1 passproxy
```

2. **Configure the frequency with which Xsigo ProWatch will transmit data.**

   For example, to configure weekly transmission:

```
set system phone-home -frequency=weekly
```

3. **Specify your company name.**

   For example, to specify that the data is sent from a company named “XYZ”:

```
set system phone-home -customer-name="Company XYZ"
```

4. **Specify the email address of a person within your company who Oracle can contact.**

   For example:

```
set system phone-home -contact-email-address=dude1@xyz.com
```

5. **Specify whether Oracle should contact you if potential problems exist.**

   For example:

```
set system phone-home -notify=true
```

6. **(Optional) Configure whether a copy of the Xsigo ProWatch information is stored locally at your company.**

   For example, to send a copy of the data to a server named “barkley” over port 5000:

```
set system phone-home -copy-url=http://barkley.xyz.com:5000
```

   The port number is optional.

7. **(Optional) Specify one or more phone numbers through which Oracle can contact you.**

   If you specify multiple phone numbers, make sure to separate each one with a comma (,). For example:

```
set system phone-home -contact-phone-numbers=”555 234 9876, 555 432 6789”
```

8. **(Optional) Control whether private data is removed from the report.**

   For example, to disable private data stripping, which results in items such as IP addresses being displayed in the report:

```
set system phone-home -strip-private=false
```

9. **(Optional) Specify whether you want a report sent to Oracle whenever a major or critical alarm occurs.**

   For example:

```
set system phone-home -send-alarms=true
```

10. **Enable the Xsigo ProWatch feature.**

11. **When prompted for confirmation, answer "yes" (**`y`**).**

    For example:

```
set system phone-home enable
This will enable periodic transmission of diagnostic data to Xsigo.
The Oracle Fabric Interconnect must have access to the internet for
an
HTTP connection in order to send the data.  Are you sure you want
to enable the phone-home facility (y/n)?y
```

12. **Display the Xsigo ProWatch configuration to verify that it is configured correctly.**

    For example:

```
show system phone-home
-----------------------------------------------------------------
enabled  true
freq     weekly
next     Thu May 19 20:35:59 GMT 20
notify   no
strip    yes
alarm    yes
name     Publications
email    dude1@xsigo.com
phone    555 234 9876,555 432 6789
copy     barkley.xsigo.com:5000
p-host   shaggy.xsigo.com:4000
p-user   proxyuser1
-----------------------------------------------------------------
1 record displayed
```

13. **(Optional) Test the ProWatch feature by issuing the** `system phone-home` **command to generate an on-demand transmission of Xsigo ProWatch data.**

    For example:

```
system phone-home
This will send quite a large amount of data to Xsigo Systems.
It requires that the Oracle Fabric Interconnect has access to the
internet
for an HTTP transfer (perhaps through a proxy if necessary).  Do
you really want to send the data (y/n)y?
```

Snoozing ProWatch

The snooze feature allows any configured phone home to be temporarily delayed for an amount of you determine. The snooze feature is helpful in many ways (for example, if you have an planned maintenance window) because it allows you to temporarily suspend phone home notifications without having to remove the phone home configuration before maintenance, then completely reconfigure it afterward. In situations, where the snooze interval is longer than needed (for example, maintenance takes an hour, but phone home is set for a two-hour snooze interval), you manually halt the snooze interval by using the off option. When the snooze interval is halted, the configured phone home interval resumes as normal.

Some additional information about the phone home snooze feature:

- During the snooze interval, alarms that occur are not transmitted, and they are not queued, so any alarms that occur while phone home is snoozed will be lost.
- During the snooze interval, you can manually transmit a phone home message (`system phone-home`) if needed.
- When specifying the snooze interval, it is possible to set a large number (for example, 999999 days) if you want phone home to snooze indefinitely but keep the phone home schedule configured.
- The snooze interval is persistent until it completes or is manually deactivated (`off`). As a result, the snooze interval does not reset if the Oracle Fabric Interconnect is reset or upgraded to a new software version, and any configured snooze interval follows the configuration even if the configuration is exported or imported.

▼ Configure Phone Home Snooze

1. **Issue the `set system phone-home snooze` command, and enter the amount of time that phone home will be suspended.**

```
set system phone-home snooze 120m
This will enable periodic transmission of diagnostic data to Xsigo
after snoozing for 2 hours.  The Oracle Fabric Interconnect must
have
access to the internet for an HTTP connection in order to send the
data.Are you sure you want to enable the phone-home facility
(y/n)?y
```

2. **(Optional) If you need to deactivate the current snooze interval, issue the set** `system phone-home off` **command.**

```
set system phone-home snooze off
```

Displaying XgOS System Configuration

Use the following commands to display various system attributes.

Syntax

```
watch {ethernet-port <slot/port>|ethernet-ports|fc-port <slot/port>|fc-ports|
    ioport <slot/port>|ioports|vhba <slot/port>|vhbas|vlans|vnic <slot/port>|
    vnics}
show alarms
show system
show system copyright
show system credits
show system date
show system dmesg
show system errors [-timefilter=[<hours>|all|lastday|lasthour]]
show system info
show system interfaces
show system license
show system log [debug|syslog]
show system loglevel
show system next-boot
show system processes
show system server-connection
show system status
show system syslog
show system syslog-server
show system user
show system version [-all]
show system warnings [-timefilter=[<hours>|all|lastday|lasthour]]
```

Parameter Description

Parameter	Description
`watch {ethernet-port|ethernet-ports| fc-port|fc-ports|ioport|ioports|vhba| vhbas|vlans|vnics|vnics}`	A dynamic window that displays the real-time performance counters of single or multiple instances of: • Ethernet ports. Use the ethernet-port option for the 10 GE module. • Fibre Channel ports • I/O ports • vHBAs • VLANs • vNICs
`show system`	Displays a summary of the system attributes: Last boot time, uptime, recent upgrades and downgrades, current base OS (Linux) version information, installed XgOS versions, memory information, and hard disk status.
`copyright`	Copyright and legal information.
`credits`	Displays the names of those responsible for this product.
`date`	Displays the current system local date and time.
`dmesg`	Base OS messages.
`errors [-timefilter=[<hours>|all|lastday |lasthour]]`	Syslog errors.
`info`	Displays system information, such as the Oracle Fabric Interconnect's management IP address, hostname and default gateway.
`interfaces`	Displays all the network interfaces in the system.
`license`	Displays the End User License Agreement.

Parameter	Description
`log [debug|syslog]`	Displays the logs. The show system log and show system log debug commands are interactive, and do not return to a command prompt after they have been issued. You must enter input to manipulate the command output (for example, pause or resume output), or exit the log file and return to the command prompt. If you do not provide any input, the system show log or system show log debug output is displayed indefinitely. Use one of the qualifiers to return to the command prompt: • `h` for this list of qualifiers • `q` - quit • `f` - enter filter • `p` - pause/resume • `-` to skip backward a little through the file • `+` to skip forward a little through the file • `/` (forward slash) to search backwards through the log for a string • Enter key to mark a position on the screen If there are no log entries, you will see the message "`Log file /log/user-debug.log is empty`," but you are still required to provide input to return to the XgOS command prompt.
`loglevel`	Displays the Syslog level of all services. The levels are as follows: • 0 XG_LOG_EMERG • 1 XG_LOG_ALERT • 2 XG_LOG_CRIT • 3 XG_LOG_ERR • 4 XG_LOG_WARNING • 5 XG_LOG_NOTICE • 6 XG_LOG_INFO • 7 XG_LOG_DEBUG
`next-boot`	Displays the location from which the system will boot next time.
`processes`	Displays process information.
`server-connection`	Displays server connection information.
`status`	Displays information on the status of the system.
`syslog`	Displays entries.
`syslog-server`	Displays the Syslog server.

Parameter	Description
`user`	Displays internal information about the current user.
`version [-all]`	Displays version information for the system, including the minimum driver version required for the purpose of keeping the XgOS and driver software in sync. Or, using -all, shows the version information for all images in the system.
`warnings [-timefilter=[<hours>|all|lastday|lasthour]]`	Displays Syslog warnings

Example: Monitor I/O Port Status

```
watch ioports
Wed Aug 17 11:25:54 PDT 2011
name type state v-res in       in-rate out    out-rate in-stats       out-stats
-------------------------------------------------------------------------------
14/1 nwEthernet10GbPort up    1    0       0      0     0       0/0/0         0/0/0
14/2 nwEthernet10GbPort down  0    0       0      0     0       0/0/0         0/0/0
14/3 nwEthernet10GbPort up    1    0       0      0     0       0/0/0         0/0/0
14/4 nwEthernet10GbPort down  0    0       0      0     0       0/0/0         0/0/0
10/1 sanFcPort       up    6    1.30985G 1917   0     0       1909/4792/2299 0/0/0
10/2 sanFcPort        down  0    0       0      0     0       0/0/0         0/0/0
4/3  nwEthernet1GbPort down  0    0       0      0     0       0/0/0         0/0/0
4/4  nwEthernet1GbPort down  1    0       0      0     0       0/0/0         0/0/0
4/5  nwEthernet1GbPort down  0    0       0      0     0       0/0/0         0/0/0
4/6  nwEthernet1GbPort up    3     332.102M 576     203102 0 460/589/437    0/0/0
4/7  nwEthernet1GbPort down  0    0       0      0     0       0/0/0         0/0/0
4/8  nwEthernet1GbPort down  0    0       0      0     0       0/0/0         0/0/0
4/9  nwEthernet1GbPort down  0    0       0      0     0       0/0/0         0/0/0
4/10 nwEthernet1GbPort down  0    0       0      0     0       0/0/0         0/0/0
2/1  sanFcPort        down  0    0       0      0     0       0/0/0         0/0/0
17 records displayed
q - quit, b - bytes, p - pkts, % - percent, m - mbps, c - clear, u - up, d - down
```

Example: Display Operating System Details

Use `show system` to display information about either the Oracle Fabric Interconnect F1-15 or Oracle Fabric Interconnect F1-4. The command's output is the same regardless of the model of Oracle Fabric Interconnect on which it is issued.

```
show system
Booted on: Tue May  6 17:15:44 GMT 2008
uptime: 1308 hours, 55 minutes, 44 seconds
RECENT UPGRADES AND DOWNGRADES
Tue Nov 4 17:15:11 GMT 2011: Upgraded to xsigo-3.6.0.xpf
Tue Nov 4 15:09:18 GMT 2011: Upgraded to xsigo-3.5.0.xpf
Fri Jul 2 14:48:19 GMT 2010: Upgraded to xsigo-3.0.0.xpf
Current Base OS Version Information
    ReleaseNumber: 176
    CompatOS:      71
    ReleaseDate:   2008/11/22 18:58:25
    KernelVersion: 2.6.22.10-xg-03
Alternative Base OS Version Information
*** No information available
INSTALLED XgOS VERSIONS
Current: xsigos-3.8.0
Previous: xsigos-3.5.0
MEMORY INFORMATION
Total memory: 995.316M
Used memory: 314.410M
Free memory: 680.906M
Swap space used: 0.000M
DISK STATUS
Partition             Size  Available       Used %used
Base OS           253.967M    77.037M   163.816M  64%  |#############--------|
XgOS                1.192G   330.699M   827.602M  67%  |##############-------|
System logs         9.169G     8.531G   175.754M   1%  |----------------------|
Database            8.249G     7.646G   188.738M   2%  |----------------------|
Temporary data      6.040G     5.701G    32.062M   0%  |----------------------|
User data           2.752G     2.522G    92.645M   3%  |----------------------|
Volatile data     184.901M   175.334M     0.021M   0%  |----------------------|
Config data        44.292M    41.952M     0.053M   0%  |----------------------|
```

Example: Display the Log Level

Use the `show system loglevel` to show the event levels configured for different processes running in the Oracle Fabric Interconnect.

```
show system loglevel
service                 processor       slot       level       level-no
-------------------------------------------------------------------------------
VNICManager             scp             1          WARNING        4
chassisMgr              scp             1          WARNING        4
chassisTestServer       scp             1          WARNING        4
CommandService          scp             1          WARNING        4
DiagService             scp             1          WARNING        4
EventManager            scp             1          WARNING        4
HealthMonService        scp             1          WARNING        4
ImageManager            scp             1          WARNING        4
IMSService              scp             1          WARNING        4
IMSSlaveService         scp             1          WARNING        4
LicenseManager          scp             1          WARNING        4
PhoneHome               scp             1          NOTICE         5
ProcessMonitor          scp             1          INFO           6
Sysconfig               scp             1          WARNING        4
Service                 scp             1          WARNING        4
StatsService            scp             1          WARNING        4
SystemController        scp             1          INFO           6
SyslogRelay             scp             1          WARNING        4
XCManager               scp             1          WARNING        4
XSM                     scp             1          WARNING        4
XSMP                    scp             1          WARNING        4
chassisCtr              fpp             1          WARNING        4
chassisTestClient       fpp             1          WARNING        4
DiagService             fpp             1          WARNING        4
ProcessMonitor          fpp             1          INFO           6
VN2agent                iop             3          WARNING        4
chassisAgt              iop             3          WARNING        4
chassisTestClient       iop             3          WARNING        4
DiagService             iop             3          WARNING        4
ProcessMonitor          iop             3          INFO           6
xvnd_svc                iop             3          WARNING        4
VN2agent                iop             4          WARNING        4
chassisAgt              iop             4          WARNING        4
chassisTestClient       iop             4          WARNING        4
DiagService             iop             4          WARNING        4
ProcessMonitor          iop             4          INFO           6
xvnd_svc                iop             4          WARNING        4
VNICAgent               iop             14         WARNING        4
chassisAgt              iop             14         WARNING        4
chassisTestClient       iop             14         WARNING        4
```

```
DiagService             iop             14          WARNING         4
ProcessMonitor          iop             14          INFO            6
42 records displayed
```

Displaying System Statistics

The system collects real-time statistics, which are displayed whenever you issue a `show <xyz> stats` command. Real-time statistics can be cleared at any time.

Syntax

Real-time statistics are available through the following commands:

```
show vnic <name> [igmp-stats|multicast-statsqueue-stats|vnic-stats]
show vhba <name> stats
set vnic <name> clear [igmp-stats|vnic-stats]
set vhba <name> clear stats
```

Example: Display vNIC Status

If a statistic is not available on a specific I/O hardware card, a question mark (?) is displayed:

```
show vnic vn0.sp2 vnic-stats
------------------------------------------------------------------------
name                  vn0.sp7
vlan-id-or-none       ?
rcv-pkt               43544
rcv-bytes             4267274
trans-pkt             43507
trans-bytes           4265073
invalid-ip-checksum   0
invalid-l4-checksum   0
mtu-err               0
ipchecksum-pkt        0
tcp-checksum-pkt      0
udp-checksum-pkt      0
tcpseg-pkt            0
green-pkt             43519
yellow-pkt            0
```

```
red-pkt              0
------------------------------------------------------------------------------
1 record displayed
```

Tracing End-to-End IB Path Continuity

A diagnostic command that supports tracing the IB path from host server, through the IB Fabric, to the I/O module that terminates the IB path on the Oracle Fabric Interconnect. This new functionality is helpful as a top-level of troubleshooting information if virtual resources are encountering a problem, or if you suspect a problem with the IB path between hosts and the Oracle Fabric Interconnect.

Displaying the IB path is supported through the `show diagnostics ib-path` command. When you issue this command, the entire IB path is displayed including the individual links that comprise the overall IB path. For example, a typical IB path might contain:

- A link from a host server's HCA to an IB switch that is sitting between the host and the Oracle Fabric Interconnect.
- A link from the IB switch to the Oracle Fabric Interconnect.
- One or more links within each Oracle Fabric Interconnect that correspond to links between the hardware on the Oracle Fabric Interconnect's Fabric Board.
- A link from the Fabric Board to the I/O module where virtual resources on the IB link are terminated.

At each of these individual links, performance statistics and error counters are tracked and displayed in a table so that you can check the functionality of the IB path at different points. The `show diagnostics ib-path` command has the following syntax:

```
show diagnostics ib-path <physical-server> {<port-num>|<wildcard>}[-clear]
```

Note – Virtual resources must be deployed to the I/O card for which you want to display the IB path. If you issue this command and nothing is displayed, no vNICs or vHBAs are configured on the server.

Additional notes about using the command:

- Statistics are not polled or refreshed at regular intervals, so you must explicitly issue the command every time you want to display a fresh or updated set of statistics.

- You can reset statistics to zero to allow them to accumulate by using the optional `-clear` argument.
- Statistics are reset if the Fabric Board is reset, for example if the Oracle Fabric Interconnect is power cycled.

▼ Determine the IB Path Continuity

As an option, if you have root access to the Oracle Fabric Interconnect, you can log in as root and issue the `ibclear errors` first, then the `ibcheckerrors` command to reset all the IB error counters. By doing so, you will have a fresh statistics gathering session. This step is not mandatory, but if you do it, you will need to log out and log back in to the Oracle Fabric Interconnect as admin to run the show diagnostics ib-path command.

1. **Note which server(s) are experiencing problems.**
2. **Log in to the Oracle Fabric Interconnect as admin user.**
3. **Issue the** `show diagnostics ib-path` **command without any qualifiers and press Tab or ? to list all servers to verify that the server is in the resulting list.**

   In the following example, the server name is "brick.".

```
show diagnostics ib-path
Possible completions:
<wildcard>              Wildcarded name
  IBM-1                   Physical server running
                          Windows/6.1.7600/x64-2.7.0.269
  IBM-2                   Physical server running
                          Windows/6.1.7600/x64-2.7.0.269
  MCKENZIE                Physical server running
                          Windows/6.1.7600/x64-4.0.0.45
  ROGUE                   Physical server running
                          Windows/6.0.6002/x64-2.7.0.47
  WILLAMETTE              Physical server running
                          Windows/6.1.7600/x64-2.7.0.269
  arlo                    Physical server
  brack                   Physical server running
                          VMware/ESX-4.0.0:xg-branch.3.8.0.esx4-/671
  brick                   Physical server running
                          VMware/4.0.0:xg-2.6.5-2/x86_64
  colusa                  Physical server running
                          Linux/2.6.18-53.el5:xg-2.6.7_RC2A/x86_64
  daisy                   Physical server running
                          VMware/4.0.0:xg-2.6.5-2/x86_64
  frack                   Physical server running
                          VMware/ESX-4.1.0:xg-3.1.0-r5722.ESX4.1/260247
```

```
  frick                    Physical server running
                           VMware/ESX-4.1.0:xg-3.1.0-r5722.ESX4.1/260247
  hca-19bbffff847ec        Physical server
  hca-2c90200253eb0        Physical server
  jumpstart                Physical server
  leven                    Physical server running
                           Linux/2.6.18-92.el5:xg-2.7.1/x86_64
```

4. **Clear the counters on the server (brick) to get a fresh batch of statistics.**

```
show diagnostics ib-path brick -clear
```

5. **Issue the** `show diagnostics ib-path` **command for the server (brick) to display the IB path and counters.**

```
show diagnostics ib-path brick *
name                  lid/port width/speed  SymErrs LnkRcov LnkDwnd RxErrs RxSwErr TxDisc TxPkts   RxPkts
-------------------------------------------------------------------------------------------------------
brick MT25408 ConnectX HCA 30/1    4X/10.0 Gbps 0      0       0       0      0       0     766260516 764409453
Infiniscale-IV Switch     36/7     4X/2.5 Gbps  0      0       0       0      0       0     4294967295 4294967295
Infiniscale-IV Switch     36/7     4X/2.5 Gbps  0      0       0       0      0       0     4294967295 4294967295
Xsigo Leaf 2 Switch       7/16     4X/2.5 Gbps  0      0       0       0      0       0     4294967295 4294967295
Xsigo Leaf 2 Switch       7/15     4X/2.5 Gbps  0      0       0       0      0       0     369118     576060
MT47396 Switch            107/6    4X/2.5 Gbps  0      0       0       0      0       0     576076     369131
MT47396 Switch            107/3    4X/2.5 Gbps  0      0       0       0      0       0     183856718  226000948
Xsigo Leaf 2 Switch       123/8    4X/2.5 Gbps  0      0       0       0      0       0     14682493   4146861
Xsigo Leaf 2 Switch       123/17   4X/5.0 Gbps  0      0       0       0      0       0     2498493    19845284
Xsigo Core Switch         121/21   4X/5.0 Gbps  0      0       0       0      0       0     19845286   2498495
Xsigo Core Switch         121/8    4X/5.0 Gbps  0      0       0       0      0       0     4294967295 4813384
Xsigo Leaf 1 Switch       122/20   4X/5.0 Gbps  0      0       0       0      0       0     4813394    4294967295
Xsigo Leaf 1 Switch       122/3    4X/2.5 Gbps  0      0       0       0      30      0     4294967295 2383197747
slot=3 vh2card            57/1     4X/2.5 Gbps  0      0       0       0      0       0     585076     351102
14 records displayed
```

The output of the command is displayed in a top-down manner, which represents the IB path's flow from the server to the module that terminates the IB path on the Oracle Fabric Interconnect. In this example, color is used to illustrate the IB path flow, and also to differentiate the various links in the overall IB path.

- The red text indicates the server HCA as one end of the IB path. The LID/Port field indicates the IB local ID and the HCA port on which the IB path exists. The width/speed show that the HCA is in QDR mode.
- the green text shows a link in the overall IB path. This link shows that an IB switch exists between the host/HCA and the Oracle Fabric Interconnect. Two entries are present—one for the ingress point and one for the egress point. Entries in the table are always ordered with the ingress point on top in keeping with overall flow of the IB path from the server to the Oracle Fabric Interconnect. The lid/port field shows local ID and port that are supporting the IB path on the IB switch.

- the magenta text shows another link in the overall IB path. These entries show how the IB path flows through the various points in the Oracle Fabric Interconnect Fabric Board. Entries are ordered in pairs to show the ingress and egress points in the Fabric Board's leaf switches/chips.
- the cyan text shows the I/O module that is the other end of the IB path, which in this example is a Fibre Channel card in slot 3 which is terminating the vHBA on the IB path.

  Fields in the command output show information about the performance of, and any errors on, the links in the overall IB path. The following table provides a brief description of the fields. Complete documentation for these fields can be found in the *InfiniBand Architecture Release 1.2.1, July 2007, Final Release*.

Field	Description
lid/port	The Local Identifier and port that the IB path is using.
width/speed	The link width and speed.
SymErrors	The Symbol Error Counter, which show the total number of minor link errors detected on one or more IB lanes.
LnkRcov	The Link Error Recovery Counter, which shows the total number of times the Port Training state machine has successfully complete a link-error recovery.
LnkDwnd	The Link Downed Counter, which shows the total number of times the Port Training state machine has not successfully completed a link-error recovery, and as a result, has put the link into "down" state.
RxErrs	The Port Receive Errors Counter, which shows the total number of packets received on the port but contained errors.
RxSwErr	The Port Receive Switch Relay Errors Counter, which shows the total number of packets received on the port that were discarded because they could not be forwarded by the switch relay.
TxDisc	The Port Transmit Discard Errors Counter, which shows the total number of outbound packets discarded by the port because the port is down or congested.
TxPkts	The Port Transmit Packets Counter, which shows the total number of packets transmitted on all Virtual Lanes from the port.
RxPkts	The Port Receive Packets Counter, which shows the total number of packets received on all Virtual Lanes on the port, including packets containing errors, and excluding link packets.

CHAPTER 17

System Management

This chapter provides reference and procedural information about managing XgOS. It contains the following sections:

- "System Image Upgrades" on page 313
- "System Configuration" on page 318
- "System Control" on page 319
- "Network Time Protocol (NTP) Server" on page 322
- "Login Methods" on page 322
- "Setting System Password Strength" on page 325
- "Setting the Oracle Fabric Interconnect Management IP Address" on page 328
- "Restoring Factory Defaults" on page 331
- "Software Information" on page 332
- "Getting System Log Files" on page 334
- "Upgrading Host HCA Option ROM and Firmware" on page 337
- "Applying System Patches" on page 347

System Image Upgrades

The XgOS software image is a Xsigo Package File (XPF) file. Use the `system upgrade` command to upgrade XgOS by supplying a URL for the path of the XPF file.

The XgOS upgrade procedure supports the following upgrade schemes:

- Hypertext Transfer Protocol (HTTP)
- HTTP over Secure Socket Layer (HTTPS)
- Secure Copy (SCP)

- File Transfer Protocol (FTP)
- Local file

TFTP system upgrades are not supported.

Before upgrading your operating system, back up your current configuration. For instructions, see "Saving and Restoring Configurations" on page 66.

The `system upgrade` and `system import` commands feature a timer that flushes out an invalid config, or a config that fails to load. If a configuration cannot be imported, the Oracle Fabric Interconnect starts a five-minute timer window. During that window, the Oracle Fabric Interconnect periodically retries the configuration. After 5 minutes, if the config still cannot be imported, the config is flushed from the system, and authentication is allowed. At this point, you can log in to the Oracle Fabric Interconnect and attempt the upgrade or import again.

Syntax

```
system upgrade [-noconfirm] http://<image-path.xpf>
system upgrade [-noconfirm] https://<image-path.xpf>
system upgrade [-noconfirm] scp://<image-path.xpf>
system upgrade [-noconfirm] file://<image-path.xpf>
system upgrade [-noconfirm] file:///usb/<image-path.xpf>
system upgrade [-noconfirm] ftp://<image-path.xpf>
system export <filename> [-cli -defaults]
system import <filename> [-cli]
```

Parameter Description

All upgrade schemes have the following general syntax:

```
scheme://user@host/image-path.xpf
```

You can omit the "user@" component if the same user name is available on the server from which you are loading the XPF file.

If the scheme is `file://`, you can omit the host.

When issuing this command, the file name will autocomplete if you omit the URL scheme or use the `file://` option.

Parameter	Description
`http://<image-path.xpf>`	Upgrade using HTTP.
`https://<image-path.xpf>`	Upgrade using HTTPS.
`scp://<image-path.xpf>`	Upgrade using SCP.
`file://<image-path.xpf>`	For upgrading from a file stored locally on the Oracle Fabric Interconnect. For example from disk, USB (a mounted /usb device), or a /home directory. In cases where you are using local upgrade through the file command, you can copy the XPF file into the Oracle Fabric Interconnect by using the file copy command.
`ftp://<image-path.xpf>`	Upgrade using FTP.
`-noconfirm`	You can perform upgrades in confirmation or non-confirmation mode. The `-noconfirm` argument is optional, and the behavior of prompts is different depending on whether you use this argument: • When you do specify `-noconfirm`, the upgrade completes without prompting you for confirmation. The argument automatically answers yes to any prompts. • When you do not specify `-noconfirm`, you will be prompted for a yes or no answer as needed during the upgrade.
`system export|import`	Before you upgrade the software, Oracle recommends you export your system configuration to a file. If your running-config gets lost during an upgrade, at least you can import the old one.

▼ Upgrade XgOS

To upgrade the XgOS system image, perform the following steps:

1. Ensure your permissions role is administrator:

```
show user
name     descr    roles            role-group
-------------------------------------------------------------
admin             administrator    administrator_group
```

2. **Issue the** `system upgrade` **command and supply the full path to the new system image.**

   Here is an example of each of the supported upgrade types.

```
system upgrade http://cairo.xsigo.com/upgrades/xsigo-V3.8.0.xpf
system upgrade https://cairo.xsigo.com/upgrades/xsigo-V3.8.0.xpf
system upgrade scp://root@cairo.xsigo.com/upgrades/xsigo-V3.8.0.xpf
system upgrade file:///upgrades/xsigo-V3.8.0.xpf
system upgrade ftp://root@cairo.xsigo.com/upgrades/xsigo-V3.8.0.xpf
```

   The CLI copies the XPF image to disk.

   If you are upgrading and the Oracle Fabric Interconnect detects that the XPF you are upgrading to is already installed and running on the Oracle Fabric Interconnect, the following message is displayed:

```
This package version is already installed, do you really want to
upgrade it (y/n)?
```

   If you are upgrading to a different XPF than is installed, the system up grade command shows the following:

```
Copying...
########################################################################## [100%]
The following software will be installed:
1. XgOS Operating System software including SCP Base OS
2. XgOS front-panel software
3. XgOS VNIC Manager and Agent software
4. XgOS VN10G Manager and Agent software
5. XgOS VN10x1G Manager and Agent software
6. XgOS VHBA Manager and Agent software
7. XgOS VHBA-2 Manager and Agent software
Are you sure you want to update the software (y/n)?y
Running preunpack scripts...
Installing...
########################################################################## [100%]
Verifying...
########################################################################## [100%
Running preinstall scripts...
Installing package...
Running postinstall scripts...
Installation successful. Please stand by for CLI restart.
admin@iowa[xsigo]
XgOS CLI is restarting - This might take a couple of minutes...
*01:00
System services are available again. Restarting the CLI now.

                    Welcome to XgOS
```

```
Copyright (c) 2007-2012 Xsigo Systems, Inc. All rights reserved.

Enter "help" for information on available commands.
```

3. **If you get the following error during the upgrade:** `Installation failed (Unable to unpack package file xsigo-<build-x>.xpf` **where** *<build-x>* **is the system image, then issue the** `system clear garbage` **command to remove any partial or failed installs.**

4. **When the Oracle Fabric Interconnect has completed its restart, issue the** `show system version` **command to verify that the new software has been installed:**

```
show system version
Build 3.8.0-XGOS  - (root) Sat May 22 06:54:53 UTC 2012
```

Clear Configuration

In general, a `system clear config` is not required before an upgrade. The only reason you might want to clear your configuration is to completely wipe it out and start over again. This command resets all values in the Oracle Fabric Interconnect's configuration database to the factory defaults. When you issue the `system clear config` command, you are prompted for confirmation before the configuration is cleared. When prompted, you must enter "confirm" to clear the configuration. Any answer other than "confirm" aborts the `system clear config` command.

Example: Clear All Configuration and Upgrade the System

```
system clear config
This is a destructive operation. Your configuration will be cleared and the
system will be restarted. Please type 'confirm' to clear the configuration and
restart the system.
>confirm
system upgrade http://cairo.xsigo.com/upgrades/xsigo-V3.8.0.xpf
system cold-restart
Are you sure you want to restart the system (y/n)? y
```

System Configuration

Issue the `show config` command to display the running configuration in table format. There is also an XML version of the configuration file in /config/config.xml.

The config.xml file is large and not easy to parse on the Oracle Fabric Interconnect. Use `file copy` to copy config.xml to some remote location and read the file with an XML reader.

Syntax

```
show config
printconfig /config/config.xml
```

Example: Display the Configuration of a F1-15

```
show config
# Xsigo System Configuration
# Model: F1-15-CH-DDR
# Serial: 050610240
# User: admin
...
```

Example: Display the Configuration of a F1-4

```
show config
# Xsigo System Configuration
# Model: F1-4-CH-DDR
# Serial: 061014816
# Date: Mon Sep 5 11:07:21 PDT 2011
# User: admin
...
```

Example: Print the Configuration

```
printconfig /config/config.xml
<top:System xmlns:top="http://www.xsigo.com/services/xmlapi/top"
 xmlns:xsigo="http://www.xsigo.com/services/xmlapi/xsigo"
 xsigo:version="Build 3.8.0  - (root) Wed May 16 00:59:43 PDT 2012
 displayedName=  "booger">
   <application:Manager xmlns:application=
     "http://www.xsigo.com/services/xmlapi/application"/>
   <composite:Manager xmlns:composite=
     "http://www.xsigo.com/services/xmlapi/composite">
   <composite:MigrateVResource xmlns:composite=
     "http://www.xsigo.com/services/xmlapi/composite"
      vResourceDN="system-local:server:virtual-mcnsp1:vhba-va1"
      destinationServerProfileDN="system-local:server:virtual-ceasar_default">
<request>
...
```

System Control

Use the `system` command to control various system attributes.

Syntax

```
system broadcast <message>
system cancel {restart|shutdown}
system clear {config|garbage|logs}
system cold-restart <message> [-delay=<sec>][-force][-noconfirm][-now]
system downgrade [<args>][-noconfirm]
system flush ims
system install [license <key>][ssh-key <key>]
system logout <session> <message>
system shutdown <message> [-delay=<sec>][-force][-noconfirm][-now]
system unmount usb
system upgrade <url> [-noconfirm] [<args>]
system verify
```

Parameter Description

Parameter	Description
`broadcast <message>`	Sends a message to all CLI users who are logged in.
`cancel {restart|shutdown}`	Cancels a pending operation.
`clear {config|garbage|logs}`	The garbage option removes garbage, such as failed image installs, from the disk.
`cold-restart <message> [-delay=<sec>] [-force][-noconfirm][-now]`	Restarts the system with the exception of the System Control Processor (SCP), and removes power from the I/O cards. When the I/O cards power up, they are completely re-initialized. This parameter puts the chassis into an operational state of "shutting down," which starts a graceful shutdown protocol. The <message> string is implemented with the "rest of line" option, so to properly use the `message` argument, place it at the end of the command.
`downgrade [<args>][-noconfirm]`	Downgrades to the previously installed image (will destroy current image).
`flush ims`	Flushes the Identity Management System (IMS) data. See "Using RADIUS as the IMS" on page 265.
`install [license <key>] [ssh-key <key>]`	Install software on the system.
`logout <session> <message>`	Forces a user to logout (administrator only).
`shutdown <message> [-delay=<sec>] [-force][-noconfirm][-now]`	Stops all processes and shuts off power to all components in the chassis. All power is deactivated. This command has the same parameters as `system cold-restart`.
`unmount usb`	Unmounts a USB token. Under normal conditions, the system can mount and unmount a USB file system without requiring this command.
`upgrade <url> [-noconfirm] [<args>]`	Upgrades the XgOS image. See "System Image Upgrades" on page 313 for more information.
`verify`	Verifies the integrity of the installation.

Example: Broadcast a Message

To broadcast a system message to all CLI users logged into the system:

```
system broadcast We should go get some lunch
```

```
Message received from admin at Mon Nov 21 21:51:02 GMT 2011
Broadcast message
We should go get some lunch
```

Examples: Initiate Immediate Cold Start

- To perform an immediate cold restart of the system:

```
system cold-restart
Are you sure you want to restart the system (y/n)? y
**********************************
Xsigo system is being shut down now
**********************************
Connection to iowa closed.
```

- To perform a cold-restart with multiple options:

```
system cold-restart -delay 300 -noconfirm restarting system in 5
minutes
```

Sends the message "restarting system in 5 minutes", but waits for 300 seconds (5 minutes) before initiating the restart. Because of the `-noconfirm` option, the restart would occur without prompting you for any confirmation.

- To perform a cold-restart with the `-force` option, which causes the system to restart as quickly as possible:

```
system cold-restart -force
```

Forces the restart process by bypassing any system checks, but still prompts for confirmation during the cold restart.

```
system cold-restart -force -noconfirm -now
```

Forces a cold restart immediately without prompting for confirmation.

Network Time Protocol (NTP) Server

Syntax

```
set system ntp-server <address> [-prefer]
show system ntp-server
remove system ntp-server <address> [-confirm]
```

Parameters

Parameters	Description
<address>	Specifies the IP address or domain name of the NTP server. For example, 192.168.99.100 or ntp.xyz.com
-prefer	An optional qualifier that specifies whether the NTP server is the preferred NTP in networks with multiple NTP servers.
-confirm	An optional qualifier that controls whether a confirmation dialog is displayed during any set or remove commands issued against the NTP server.

Login Methods

You can log into the CLI using the console or SSH. Telnet is not supported. Up to 20 concurrent CLI sessions can be established on the chassis (limited by the number of instances available in the address object).

Console Login

The console port is the Serial 1 port (top) on the Management module. The Serial 2 port (bottom) is used for engineering debug purposes only.

Here are the default console serial port settings:

- Baud rate: 115200 bps

- Data bits: 8
- Stop bits: 1
- Parity: none
- Flow control: none

The default username is “admin”. The default password is “admin”. XgOS places you directly into a CLI session with full administrative privileges:

```
login: admin
Password: ********
                    Welcome to XgOS
Copyright (c) 2007-2012 Xsigo Systems, Inc.  All rights reserved.
Enter "help" for information on available commands.

pwd
/home/admin
show user
name           descr          roles                   role-group
-------------------------------------------------------------------
admin                        administrator         administrators
1 record displayed
```

SSH Login

Use SSH to log into the CLI remotely. Telnet is not supported:

```
$ ssh admin@192.168.8.133
Password: xxxx
                  Welcome to XgOS
Copyright (c) 2007-2012 Xsigo Systems, Inc. All rights reserved.
Root Login
```

To log into the system as root, then `su admin` back into the user CLI:

```
$ ssh root@iowa
Password:
iowa:~# su admin
Password:
```

Note – For security reasons, ssh root login can be disabled or enabled. See “Disable or Enable Root Login Over SSH” on page 324.

▼ Change `root` Password

The default root password is `root`. To change your root password:

1. Log in as the administrator:

```
$ ssh admin@iowa
Password:
```

2. Set the new root password:

```
set system root-password
Old password:
New password:
New password again:
```

Note – As with any system, take care to keep track of your root password. If you forget it, Oracle will not be able to help you by recovering it.

▼ Disable or Enable Root Login Over SSH

- **Disable ssh root login:**

```
$ ssh admin@iowa
Password:
set system root-ssh-login disable
```

- **Enable ssh root login:**

```
$ ssh admin@iowa
Password:
set system root-ssh-login enable
```

Display Login Information

Use `show login` and `show users` to display details about the active CLI sessions and configured local user accounts, which are user accounts that are configured directly on the Oracle Fabric Interconnect. User accounts configured through LDAP and RADIUS are not displayed through show login or show user.

Use `set cli idle-timeout 0` to configure an infinite CLI time-out (no time-out). For information about creating using accounts, see "Create a User Account" on page 251.

Syntax

```
show login [<session-id>]
show user
```

Example

```
show login
-------------------------------------------------------------------
session          1
time             2011-08-20 21:28:20
name             admin
descr
roles            administrator
interface        cli
type             local
logged-in-from   172.16.48.120
-------------------------------------------------------------------
1 record displayed
show users
-------------------------------------------------------------------
name           admin
descr
roles          administrator
role-group     administrators
```

Setting System Password Strength

For non-default local users that log in to the Oracle Fabric Interconnect, are prompted with password for authentication. Through XgOS you can set the strength of password by specifying criteria for the passwords. The strength of passwords is supported through the `set system password-strength` command. The following criteria can be set for system passwords:

- the minimum number of characters allowed for the password string.
- the minimum number of lowercase letters required for Oracle Fabric Interconnect passwords.

- the minimum number of numbers required for Oracle Fabric Interconnect passwords.
- the minimum number of special characters required for Oracle Fabric Interconnect passwords.
- the minimum number of uppercase letters required for Oracle Fabric Interconnect passwords.

This feature is supported for local passwords, which are the passwords that allow users to log in to the Oracle Fabric Interconnect. The following passwords are not affected by the password strength feature:

- Oracle Fabric Manager login passwords
- Passwords authenticated through AD or another Identity Management System (IMS) are not supported by this command.
- The default user admin password (`root` or `admin`).

This feature is supported only for passwords configured with XgOS 3.8.0 and later. Passwords that were configured on the Oracle Fabric Interconnect through a version of XgOS earlier than 3.8.0 are not affected by this enhancement. If you want those passwords to use the password strength enhancement, you will need to reset those passwords.

Syntax

```
set system password-strength <arguments>
```

Parameters

Parameter	Description
-min-length	Is a number from 0 to 20 that sets the minimum number of characters in the password
-min-lower-case	Is a number from 0 to 20 that sets the minimum number of lower case letters in the password
-min-number	Is a number from 0 to 20 that sets the minimum number of numbers in the password
-min-special	Is a number from 0 to 20 that sets the minimum number of special characters in the password
-min-upper-case	Is a number from 0 to 20 that sets the minimum number of upper case letters in the password

Example

```
set system password-strength -min-length=8 -min-lower-case=3 -min-number=2
    -min-special=2 -min-upper-case=1
```

In this example, the password for non-default local user accounts must be at least 8 characters, and must contain at least 3 lower case characters, 2 numbers, 2 special characters, and 1 uppercase character.

Setting the Oracle Fabric Interconnect Management IP Address

To use the Oracle Fabric Interconnect's management interface remotely, you must configure an IP address and prefix length for the interface. You initially configure these parameters when you first run the installation wizard at the console port. If you have changes to your management network, you might need to change the IP address you use for the Oracle Fabric Interconnect.

▼ Set or Change the Management Address of the Oracle Fabric Interconnect

1. **(Optional) Use** `show system info` **to check the current setting.**

   For example:

```
show system info
-------------------------------------------------------------------
hostname          myserver
domain            samples.xsigo.com
address           192.168.10.85
netmask           255.255.255.0
nameservers       10.10.0.12, 10.10.0.11
model-num         F1-15-CH-SDR
serial-num        160610550
ipconfig          static
default-gateway   172.16.6.1
timezone          GMT
domain-search
is-sm             true
console-speed     115200
phone-home        true
root-ssh-login    enabled
-------------------------------------------------------------------
1 record displayed
```

2. **The output indicates that the current IP address is 192.168.10.85.**

3. **If other administrators might be managing virtual I/O, use** `show login` **to check if anyone is logged on:**

4. **If** `show login` **indicates that others are logged on, issue a system broadcast to warn them of the change.**

   For example:

```
system broadcast Changing management IP to 192.168.10.97 in 2
minutes!
```

Note – Changing the system management address can affect management connectivity to the Oracle Fabric Interconnect for other administrators and for management systems. If you are remotely connected, this command will break that connection. Take this into account before making the change.

---

5. **Use** `set system management-interface` **command to change the IP address and any other related parameters:**

```
set system management-interface ?
Possible completions:
  [Optional qualifiers]
    -address           IP address/netmask (e.g.  192.168.3.56/24)
    -default-gateway   Default gateway IP address
    -domain            Domain
    -domain-search     List of domain names (space separated, enclosed in quotes)
    -hostname          Hostname
    -ipconfig          IP Address configuration type (DHCP/static)
    -nameservers       List of name servers (IP addresses, comma separated)
    -netmask           IP netmask (e.g 255.255.255.0)
    -ntpservers        List of NTP servers (hostnames, comma separated)
```

The qualifiers for the `set system management-interface` command are available as individual commands also. For example, the `set system address` is the equivalent of the `set system management-interface -address` command.

However, by using the `set system management-interface` command, you have the following distinct advantages:

You can see all the relevant parameters in one location, which facilitates completing the management interface's configuration.

You can string as many of the qualifiers together into one command, which typically leads to less typing and a quicker time configuring the management interface.

For example, you can set or change the management interface's IP address as well as change the domain in which the Oracle Fabric Interconnect exists, and also rename the Oracle Fabric Interconnect in one command instead of three (in previous releases):

```
set system management-interface -address 192.168.10.97
    -domain poclab.xsigo.com -hostname pubstest
```

6. **(Optional) When you are done with setting or changing the management interface, verify that the new information is active.**

   For example:

```
show system info
---------------------------------------------------------------------
hostname         pubstest
domain           poclab.xsigo.com
address          192.168.10.97
netmask          255.255.255.0
nameservers      10.10.0.12, 10.10.0.11
model-num        F1-15-CH-SDR
serial-num       160610550
ipconfig         static
default-gateway  172.16.6.1
timezone         GMT
domain-search
is-sm            true
console-speed    115200
phone-home       true
root-ssh-login   enabled
---------------------------------------------------------------------
1 record displayed
```

The output indicates that the current IP address is now 192.168.10.97.

Restoring Factory Defaults

XgOS supports resetting any Oracle Fabric Interconnect to its factory defaults, which is the Oracle Fabric Interconnect's original state when it was shipped from Oracle. When factory defaults are restored, all configuration information (including the Oracle Fabric Interconnect node name and system management IP address) is cleared.

Note – Restoring factory defaults is dangerous. As a result, you should issue it only when you are sure it is safe to lose all configuration.

Due to the dangerous nature of this operation, the following requirements exist:

- The user restoring the factory defaults must have the "administrators" role.
- The command requires confirmation before completing. To confirm the command, enter the word "confirm" (in lower case, no quotation marks) when prompted.

Note – If you want only to clear the current configuration from the Oracle Fabric Interconnect, use the `system clear config` command instead of restoring factory defaults.

Effects on the Oracle Fabric Interconnect

When you set the Oracle Fabric Interconnect to factory defaults:

- All files on the hard drive are removed (including user files, config files, and the config database)
- The Oracle Fabric Interconnect host name is reset to `xsigo-`<mac-addr> where <mac-addr> is the Oracle Fabric Interconnect's MAC address
- The system interface is reset to DHCP mode
- All log files are emptied out
- The root, RCLI, and admin passwords are reset

When the Oracle Fabric Interconnect is reset to factory defaults, critical system processes continue to run, but the Oracle Fabric Interconnect control software is shut down. As a result, the Oracle Fabric Interconnect will continue to pass traffic but cannot be managed until power is removed and reapplied.

Power Down and Power Up

Because this command removes all configuration, you will typically only use this command shortly before the Oracle Fabric Interconnect is powered off. You can power off the Oracle Fabric Interconnect by removing both power cables. After you restore factory defaults, the Oracle Fabric Interconnect can be manually restarted by physically restoring facility power (reinserting power cables).

Syntax

```
set system factory-default
```

Example

```
set system factory-default
This is a very destructive operation.  It will completely clear all state in the
Oracle Fabric Interconnect and shut down the system software.  The system
willcontinue to pass traffic but will not be manageable.  You will need to power
the Oracle Fabric Interconnect off by manually removing the power cords.

DO NOT CONFIRM THIS COMMAND IF YOU DON'T WANT TO LOSE EVERYTHING IN THE DIRECTOR.

Type 'confirm' to set the system to factory default state.
>confirm
```

Software Information

Use the `show software` command to display software information.

Syntax

```
show software
```

Example

```
show software
## System status ##################################################################
Booted on: Wed Mar 19 21:05:28 GMT 2008
uptime: 48 days, 21 hours, 5 minutes, 55 seconds
RECENT UPGRADES AND DOWNGRADES
Tue Nov 4 17:15:11 GMT 2008: Upgraded to xsigo-3.6.0.xpf
Tue Nov 4 15:09:18 GMT 2008: Upgraded to xsigo-3.5.0.xpf
Fri Jul 2 14:48:19 GMT 2008: Upgraded to xsigo-3.0.0.xpf
Current Base OS Version Information
    ReleaseNumber: 176
    CompatOS:      71
    ReleaseDate:   2008/04/22 18:58:25
    KernelVersion: 2.6.22.10-xg-03
Alternative Base OS Version Information
*** No information available
INSTALLED XgOS VERSIONS
Current: xsigos-3.8.0
Previous: xsigos-3.5.0
MEMORY INFORMATION
Total memory: 995.316M
Used memory: 314.059M
Free memory: 681.258M
Swap space used: 0.000M
DISK STATUS
Partition             Size  Available       Used %used
Base OS           253.998M    60.842M   180.041M  70%  |################-------|
XgOS                1.192G   470.137M   688.164M  56%  |#################------|
System logs         9.169G     8.516G   191.484M   2%  |----------------------|
Database            8.249G     7.634G   200.582M   2%  |----------------------|
Temporary data      6.040G     5.701G    32.062M   0%  |----------------------|
User data           2.752G     2.581G    32.324M   1%  |----------------------|
Volatile data     184.901M   175.341M     0.014M   0%  |----------------------|
Config data        44.292M    41.969M     0.036M   0%  |----------------------|
## Processes ####################################################################

name             processor slot memory   cpu-time num-restarts time-started
--------------------------------------------------------------------------------
chassisCtr        fpp       1    5.60547  00:00:01 0            2008-05-06 17:18
chassisAgt        iop       3    4.78516  00:00:00 0            2008-05-06 17:30
vhbaagent         iop       3    5.26953  00:00:01 0            2008-05-06 17:30
chassisAgt        iop       4    4.875    00:00:00 0            2008-05-06 17:20
vhbaagent         iop       4    5.16797  00:00:01 0            2008-05-06 17:20
chassisAgt        iop       5    4.76953  00:00:00 0            2008-05-06 17:19
vnicagent         iop       5    7.48438  00:00:01 0            2008-05-06 17:19
vn2_agent         iop       10   4.58594  00:00:00 0            2008-05-06 17:19
chassisAgt        iop       10   4.75     00:00:00 0            2008-05-06 17:19
```

```
start_xvnd.sh     iop       10   5.89453  00:01:25 0            2008-05-06 17:19
apache2_prerun.sh scp            0        00:00:00 0            2008-05-06 17:26
xtctrl            scp            0        00:00:00 0            2008-05-06 17:26
vnctrl            scp            0        00:00:00 0            2008-05-06 17:26
resurrect_db      scp            0        00:00:00 0            2008-05-06 17:26
reap_db           scp            0        00:00:00 0            2008-05-06 17:26
resurrect_sysctl  scp            0        00:00:00 0            2008-05-06 17:26
vnctrl            scp           0.582031 00:00:00 0            2008-05-06 17:19
xsmib_service     scp           0.796875 00:00:00 0            2008-05-06 17:17
xgdiscoverd       scp           0.839844 00:00:00 0            2008-05-06 17:17
xtctrl            scp           0.921875 00:00:00 0            2008-05-06 17:19
xdsd              scp           1.14453  00:00:01 0            2008-05-06 17:17
opensm            scp           1.84375  00:00:05 0            2008-05-06 17:17
postmaster        scp           2.85156  00:00:00 0            2008-05-06 17:17
snmpagent         scp           16.8359  00:00:03 0            2008-05-06 17:17
apache2           scp           22.4375  00:00:10 0            2008-05-06 17:17
imagemanager      scp       1   4.16797  00:00:00 0            2008-05-06 17:17
xc_xsmp           scp       1   13.3438  00:00:00 0            2008-05-06 17:17
xc_xsm            scp       1   14.3203  00:00:08 0            2008-05-06 17:17
healthmonitor     scp       1   15.7227  00:00:13 0            2008-05-06 17:17
scd               scp       1   15.8555  00:00:10 0            2008-05-06 17:17
chassisMgr        scp       1   17.125   00:00:08 0            2008-05-06 17:17
systemcontroller  scp       1   18.8633  00:00:35 0            2008-05-06 17:17
scriptsvc         scp       1   35.0039  00:00:01 0            2008-05-06 17:17
vhbamanager       scp       1   40.1445  00:00:07 0            2008-05-06 17:17
vnicmanager       scp       1   40.3633  00:00:06 0            2008-05-06 17:17
xc_manager        scp       1   43.4492  00:00:13 0            2008-05-06 17:17
mimm              scp       1   45.1914  00:00:18 0            2008-05-06 17:17
39 records displayed
## Core dumps (in /log/coredumps/)
################################################################
```

Getting System Log Files

XgOS supports gathering information from the Oracle Fabric Interconnect and some host information and compiling all the information into compressed files. These files can then be sent to Oracle Customer Support for their diagnosis.

```
show software
show tech-support > <output-file>
get log-files <output-file> -all
```

```
get log-files <output-file> -noarchives
get log-files <output-file> -nocores
get log-files <output-file> -silent
```

Parameter Description

Parameter	Description
`show tech-support > <output-file>`	Send content of show tech-support to a file. You must use the redirection switch (>) to redirect the output to the file.
`get log-files <output-file> -all`	Gather all log, archive, and core files and put them into `xsigo-logs.tar.gz`
`get log-files <output-file> -noarchives`	Gather all log and core files (but not archived log files) and put them into `xsigo-logs.tar.gz`
`get log-files <output-file> -nocores`	Gather all current and archived log files (but not core files) and put them into `xsigo-logs.tar.gz`
`get log-files <output-file> -silent`	Gather all log, archive, and core files and put them into `xsigo-logs.tar.gz` without displaying any on-screen progress.

Example: Redirect `show tech-support`

Use the redirection switch (>) to send the current show tech-support contents to an output file, which can then be sent off of the Oracle Fabric Interconnect, for example to Oracle Customer Support.

```
show tech-support > test112011
```

There is no progress indicator, or a completion message. When the command prompt returns, the command has completed.

Example: Gather All Files With `get log-files -all`

Use the get log-files command to gather all available files, logs, and cores, as well as the output of show tech-support, and put it into a gzipped tar file, which can then be sent off of the Oracle Fabric Interconnect, for example to Oracle Customer Support.

```
get-log-files -all
copying /log/cli.log...
copying /log/createdb.log...
copying /log/daemon.log...
copying /log/dumpster.log...
copying /log/ib.log...
copying /log/install.log...
copying /log/kern.log...
copying /log/osm.log...
copying /log/postgresql.log...
copying /log/syslog.log...
copying /log/upgrade.log...
copying /log/upgrade_sw.log...
copying /log/user-debug.log...
copying /log/user-debug_old.log...
copying /log/user.log...
copying /log/xdsd.log...
copying /log/xms.log...
copying /log/createdb.log.1.gz...
copying /log/dmesg.1.gz...
copying /log/dmesg.2.gz...
copying /log/dmesg.3.gz...
copying /log/dmesg.4.gz...
copying /log/ib.log.1.gz...
copying /log/ib.log.2.gz...
copying /log/ib.log.3.gz...
copying /log/ib.log.4.gz...
copying /log/ib.log.5.gz...
copying /log/osm.log.1.gz...
copying /log/osm.log.2.gz...
copying /log/postgresql.log.1.gz...
copying /log/postgresql.log.2.gz...
copying /log/syslog.log.1.gz...
copying /log/user-debug.log.10.gz...
copying /log/user-debug.log.1.gz...
copying /log/user-debug.log.2.gz...
copying /log/user-debug.log.3.gz...
copying /log/user-debug.log.4.gz...
copying /log/user-debug.log.5.gz...
copying /log/user-debug.log.6.gz...
```

```
copying /log/user-debug.log.7.gz...
copying /log/user.log.8.gz...
copying /log/user.log.9.gz...
copying /log/wtmp.1.gz...
copying /log/coredumps/dmsg_iocard-8_ts67_0...
copying /log/coredumps/dmsg_iocard-8_ts68_0...
copying /log/coredumps/dmsg_iocard-8_ts74_0...
copying /log/coredumps/dmsg_iocard-8_ts86_0...
copying /log/coredumps/mimm.1727.core...
Warning: cannot open file: /log/coredumps/mimm.1727.core
copying /log/coredumps/mimm.5532.core...
Warning: cannot open file: /log/coredumps/mimm.5532.core
copying /log/coredumps/snmpagent.1653.core...
Warning: cannot open file: /log/coredumps/snmpagent.1653.core
copying /log/coredumps/snmpagent.25697.core...
Warning: cannot open file: /log/coredumps/snmpagent.25697.core
copying /log/coredumps/systemcontrolle.23348.core...
Warning: cannot open file: /log/coredumps/systemcontrolle.23348.core
copying /log/coredumps/systemcontrolle.26447.core...
Warning: cannot open file: /log/coredumps/systemcontrolle.26447.core
copying /log/coredumps/systemcontrolle.851.core...
Warning: cannot open file: /log/coredumps/systemcontrolle.851.core
*** output file is xsigo-logs.tar.gz (49.12M)
You can use the 'file copy' command to transfer it off the Xsigo system
```

Upgrading Host HCA Option ROM and Firmware

Each host server connected to a Oracle Fabric Interconnect has at least one HCA installed to provide the InfiniBand (IB) connection to the Oracle Fabric Interconnect. On the host's HCA, an Option ROM and firmware are present that support the IB connectivity, data traffic, and some Oracle proprietary tools. Even though the HCA is a host component, not technically part of the Oracle Fabric Interconnect, XgOS can be used to upgrade the Option ROM version and firmware that the HCA uses.

Upgrading the host's Option ROM or firmware occurs in-band through commands on the Oracle Fabric Interconnect that are sent to the HCA. Because the HCA upgrade is in-band, no service interruption occurs while the new packages are being put on the HCA. However, to load the new Option ROM or firmware into memory on the HCA, the server must be rebooted, which does cause a brief service interruption.

Considerations

When you perform the upgrade, be aware of the following:

- You can selectively upgrade. You upgrade either the Option ROM, or the firmware, or you can do both at the same time.
- You must upgrade all HCAs in a particular server that is connected to a Oracle Fabric Interconnect. At present, you cannot selectively upgrade some HCAs in the server, but not others.
- You can upgrade HCAs in one or all servers. Through the use of either a specific server name or a wildcard (*), you can upgrade a single server or all servers in your data center.
- The upgrade occurs from whatever Option ROM is currently in use on the HCA to the package that is currently on the Oracle Fabric Interconnect. When you upgrade, the package on the Oracle Fabric Interconnect is pushed to the HCA, which typically results in a newer version being installed on the host.
- Currently, there is no “unpatch” or “revert” function for the in-band firmware upgrade feature. As a result, if you use the feature to upgrade an HCA, then need to downgrade to a previous version, you will need a specific procedure. Contact Oracle Customer Support.
- The in-band upgrade functionality is currently supported for ConnectX, ConnectX-2, and ConnectX-3 HCAs only.
- The upgrade operates with silent completion. If no error messages are displayed during the upgrade, it is implied that the upgrade was successful.
- You can only upgrade HCAs that are directly connected to a Oracle Fabric Interconnect, and the Oracle Fabric Interconnect can only upgrade HCAs that are directly connected to its fabric. In a configuration in which HCAs exist in a server, and each HCA is configured to multiple fabrics, you must perform the in-band upgrade for each fabric to get all HCAs upgraded.
- You can only upgrade HCAs if the host that contains them is running Oracle host drivers that have been loaded into the host’s memory.
- For example, in a multi-chassis HA configuration, assume a server has two HCAs (HCA1 and HCA2). HCA1 is connected to Oracle Fabric Interconnect 1’s fabric (Fabric 1), and HCA 2 is connected to Oracle Fabric Interconnect 2’s fabric (Fabric 2). In this case, you would need to perform the upgrade twice—once for the HCA on Fabric 1, and once for the HCA on Fabric 2.
- If errors occur during the upgrade, XgOS displays an error message. In addition, more robust error text is written to the user log (user.log) on the chassis. If you see an error, or suspect that the upgrade did not complete successfully, you can check user.log for information that might facilitate your troubleshooting or your interaction with Oracle Customer Support.

- It is important to understand that the in-band firmware upgrade procedure is not complete until the HCA is rebooted. Until then, the new Option ROM and firmware are resident on the HCA, but not yet active because they have not yet been loaded into memory.
- The in-band upgrade procedure does not automatically perform the reset, so you must reboot the HCA (or server) to complete the upgrade procedure. Oracle has designed the feature this way to enable you to load new Option ROM and firmware at any time, then choose an optimal time to perform the HCA reset—for example, during a maintenance window or other times of relatively low traffic. While the Option ROM and firmware are on the HCA, traffic is supported, but when the HCA is rebooted, service will temporarily be interrupted.
- Also, the Oracle Fabric Interconnect has no way to reboot the HCAs that were upgraded, or their servers. As a result, to complete the in-band upgrade, you must log in to and manually reboot the server(s) to complete the Option ROM or firmware upgrade.

Get the Latest Option ROM and Firmware

The latest version of the Option ROM and firmware are not provided by Oracle as part of the Oracle Fabric Interconnect's XgOS software.

- You will need to obtain the latest version of HCA Option ROM from Oracle, which makes Option ROM images available for download.
- You will need to obtain the latest version of the correct firmware from either Oracle, the server manufacturer, or the HCA vendor (for example, Mellanox).

You will need to know specific information about the HCA board ID to figure out the correct version of firmware to download and install on the Oracle Fabric Interconnect.

When you locate the Option ROM and firmware, you will need to get it onto the Oracle Fabric Interconnect. Three different protocols are supported for getting the images onto the Oracle Fabric Interconnect:

- scp
- http
- file for USB access

Install Option ROM and Firmware and Pushing it to Hosts

When the Option ROM and firmware images are installed on the Oracle Fabric Interconnect, they are unpacked to the `/install` directory. Any previous versions of Option ROM or firmware are not automatically deleted. In fact, the Oracle Fabric Interconnect retains a maximum of 64 images. If you need to delete some images, you can do so through a software command. After the images are installed, they are available on the Oracle Fabric Interconnect, and through software commands, you can push the upgrade to connected hosts.

Command Syntax

```
show physical-server <name>
show physical-server <name> hca
show system hca-firmware
show system hca-optionrom
set physical-server <name> upgrade-hca <lid> firmware <filename>
set physical-server <name> upgrade-hca <lid> optionrom
set physical-server <name> upgrade-hca <lid> remove-optionrom
set physical-server <name> upgrade-hca <lid> reset
system install hca-image scp://<path-to-image>
system install hca-image http://<path-to-image>
system install hca-image file:///usb/<image-path>
system remove hca-firmware <filename>
system remove hca-optionrom <filename>
```

Parameter Description

The Option ROM and firmware upgrade command have the following options:

Parameter	Description
<name>	Specifies the name of the server that contains the HCA that will be upgraded, or allows all servers to be upgraded.
<lid>	Specifies the InfiniBand local Identifier for the HCA that you want to upgrade.
<filename>	Specifies the name of the Option ROM or firmware file that you will be using for the upgrade.
`http://`<path-to-image>	Specifies the URL to the Option ROM or firmware file you want to use for the upgrade through HTTP.
`scp://`<image-path>	Specifies the URL to the Option ROM or firmware file you want to use for the upgrade through SCP. Make sure you include the file name in the path. The firmware file will typically be `a.bin` file, and the Option ROM file will typically be a `.TAR` file.
`file:///usb/`<image-path>	Specifies the file path to the Option ROM or firmware file you want to use for upgrading from a USB device locally attached and mounted in the Oracle Fabric Interconnect file system. Make sure you include the file name in the path. The firmware file will typically be a.bin file, and the Option ROM file will typically be a `.TAR` file.

Resetting the HCA

If needed, resetting the HCA allows you to halt any in-progress update of the Option ROM or firmware that is interrupted or hung. This option is also useful if the update halts while pushing the Option ROM or firmware image to the host's HCA. Use this command to manually clear the semaphore lock on the HCA.

```
set physical-server alma upgrade-hca 14 reset
Resetting HCA 2c903000459eb ...
```

When you use the `reset` command, you do not need to reboot the server for it to take effect.

For example, if you have link state for the HCA but the following error is displayed, you would want to use the `reset` command to be able to restart the upgrade session on the HCA

```
set physical-server alma upgrade-hca 14 firmware
Retrieve version information...
Upgrade of HCA for 2c903000459eb failed: Cannot access server's HCA
lid-14
```

Displaying All Option ROM Images on the Oracle Fabric Interconnect

At any time, you can display a list of all the Option ROM and firmware images installed on the Oracle Fabric Interconnect. The Oracle Fabric Interconnect can retain a maximum of 64 images, but has no restriction on the mix of Option ROM or firmware images that comprise the total.

```
show system hca-optionrom
hca-optionrom            revision size  date             md5-checksum

------------------------------------------------------------------------------
XgBoot-mt25204.bin      2.2.12   52736 2011-08-02 13:10 8145c0c876a858d12a9e4b9
99353d1fd
XgBoot-mt25204-DEBUG.bin 2.2.12   58880 2011-08-02 13:10 26f743e9001af67e9ef4901
6140e277a
XgBoot-mt25218.bin      2.2.12   52736 2011-08-02 13:10 c73639ac829b348bb850ad1
485661e3b
XgBoot-mt25218-DEBUG.bin 2.2.12   58880 2011-08-02 13:10 258bb99e6c78d6080ad8613
49ccb0fdb
XgBoot-mt25408.bin      2.8.7    77312 2011-08-02 13:10 b36c1523be8eb328b69de01
6a41c9a81
XgBoot-mt25408-DEBUG.bin 2.8.7    77312 2011-08-02 13:10 8e908d9f3c45dbf75e96c9b
04bf2e6f4
XgBoot-mt25418.bin      2.8.7    77312 2011-08-02 13:10 733193b284382f92604d719
6e4352eff
XgBoot-mt25418-DEBUG.bin 2.8.7    77312 2011-08-02 13:10 170900760b28dbbaff0ed45
00d10d2d9
XgBoot-mt26418.bin      2.8.7    77312 2011-08-02 13:10 8ca703848be309d858c38ec
4b529ed3b
XgBoot-mt26418-DEBUG.bin 2.8.7    77312 2011-08-02 13:10 2758184d5c5bc901021e7de
09b9f5431
XgBoot-mt26428.bin      2.8.7    77312 2011-08-02 13:10 41897d9749577495cc0c907
9cfa0adb8
```

```
XgBoot-mt26428-DEBUG.bin 2.8.7   77312 2011-08-02 13:10 fd0ab3efe0065b3dbb79a2d
8ac804c34
12 records displayed
```

Displaying All Firmware Images on the Oracle Fabric Interconnect

At any time, you can display a list of all the firmware images installed on the Oracle Fabric Interconnect. The Oracle Fabric Interconnect can retain a maximum of 64 images, but has no restriction on the mix of Option ROM or firmware images that comprise the total.

```
show system hca-firmware
hca-firmware                                              size   date
     md5-checksum
-------------------------------------------------------------------------------
fw-23108-3_5_0-MHET2X-1TC_A1.bin                          837252 2012-03-14 15:39
     d7a83af02915128dd4fa202401537ee2
fw-ConnectX2-2_8_0000-592519-B21-clp-180.bin              648908 2012-03-19 16:42
     29d6bcb15d4f606ac93d8528cca6f584
fw-25408-2_9_1000-MHGH29-XTC_A2.bin                       547028 2011-06-29 08:52
     a6c9f79168e7f7b8a8826920f3c34c3e
fw-25408-2_9_1000-MHQH29-XTC_A2-A3.bin                    547788 2011-08-02 13:10
      b319721004d440ea0cd5af1cd2f9b4bd
fw-ConnectX2-2_7_700-592519-B21.bin                       560460 2011-10-11 10:23
      c1da2f1dcc3a2dbce473a1c306dd08f
31 records displayed
```

Removing the Option ROM

If needed, you can delete an installed Option ROM image from the Oracle Fabric Interconnect by issuing the `system remove hca-optionrom` command.

```
system remove hca-optionrom <file-name>
```

Removing the Firmware

If needed you can delete an installed Option ROM image from the Oracle Fabric Interconnect by issuing the `system remove hca-figure` command.

```
system remove hca-firmware <file-name>
```

Upgrading the Option ROM and Firmware Images

You can upgrade the firmware on an HCA by following this procedure, which assumes the server "kingston" will be upgraded.

▼ Upgrade the Option ROM and Firmware Images

1. **Issue the show physical-server display HCA information about the server's HCA.**

```
show physical-server kingston hca
------------------------------------------------------------------
lid               7
node-guid         0002c903000a9f7a
board-id          MT_0A50120005
device-id         26418
firmware-version  2.7.0
hardware-version  unknown
option-version    2.8.7
------------------------------------------------------------------
1 record displayed
```

   Note the value in the `lid` and `board-id` fields. You will use the LID when you upgrade the HCA, and you will use the board ID in the next step.

2. **Log into HCA vendor's site (for example, Mellanox) or the server manufacturer's site, and use the board ID to find the correct firmware version for the HCA.**

3. **When you find the correct firmware version, download it to the Oracle Fabric Interconnect.**

   For example:

```
system install hca-image
 scp://mellanox/downloads/firmware/mt_0a5012xxxx/file1234
```

   When this step completes, the firmware file is installed to the Oracle Fabric Interconnect's `/install` directory where a total of 64 Option ROM and firmware images can be kept.

4. **Log in to the Oracle Xsigo Support Portal and download the Option ROM tar file.**

   For example:

```
system install hca-optionrom
 scp://xsigo/support/downloads/optionrom-2.9.7.tar/
```

   When this step completes, the Option ROM tar file is extracted and all the individual Option ROM files are installed to the Oracle Fabric Interconnect's `/install` directory where a total of 64 Option ROM and firmware images can be kept. After the files are installed, the `TAR` file is deleted.

5. **If you copied the Option ROM to somewhere other than the Oracle Fabric Interconnect, copy the file onto the Oracle Fabric Interconnect.**

6. **When the Option ROM and firmware images are on the Oracle Fabric Interconnect, upgrade the required files.**

   You can upgrade either the Option ROM or the firmware or both.

7. **(Optional) Send a system broadcast to anyone else connected to the Oracle Fabric Interconnect to let them know that you will be updating one or more hosts.**

   For example:

```
system broadcast "Upgrading HCA firmware for server kingston"
```

8. **If you are upgrading both the Option ROM and the firmware, make sure to upgrade the Option ROM before upgrading the firmware. Proceed to step** Step 12

9. **If you are upgrading the Option ROM only, proceed to step** Step 12

10. **If you are upgrading the firmware only, proceed to** Step 11

11. **Upgrade the firmware by issuing the** `set physical-server` **command.**

    For example:

```
set physical-server kingston upgrade-hca 7 firmware 3.0.0-fw.bin
Retrieve version information...

Upgrading HCA 0002c903000a9f7a firmware from 2.9.1000 to 3.0.0 will require a
manual server reboot in order to take effect.  Do you wish to continue (y/n)?y

Upgrading HCA for 0002c903000a9f7a, current version is 2.9.1000...
```

Note – The CLI will temporarily pause while the new firmware is being pushed to the HCA. When the HCA is successfully put on to the HCA, XgOS returns to the command prompt.

12. **Upgrade the Option ROM by issuing the** `set physical-server` **command and specifying the server's LID.**

    For example:

```
set physical-server kingston upgrade-hca 7 optionrom
Upgrading HCA 2c903000459eb optionrom may interrupt I/O and will require a manual
server reboot in order to take effect.  Do you wish to continue (y/n)?y
```

Note – The CLI will temporarily pause while the new firmware is being pushed to the HCA. When the HCA is successfully put on to the HCA, XgOS returns to the command prompt.

13. **Issue the** `show physical-server hca` **command, and verify that the new firmware was installed.**

```
show physical-server kingston hca
Selected card:
   Node GUID          : '0002c903000a9f7a'
   Board ID           : 'MT_0A50120005'
   Firmware version   : '3.0.0'
   Hardware version   : 'A0'
   Option ROM version : '2.8.7'
```

    If the `Firmware version` of `Option ROM version` field shows `unknown`, then that software image is not present on the HCA.

14. **When the correct image(s) are present, log in to the host and reboot it to load the new images into memory.**

Applying System Patches

A system patch is an XPF (Xsigo Package File) that provides a focused fix for a specific file or files in the Oracle Fabric Interconnect file system. A patch tends to be smaller and more manageable, and allows for applying hot-fixes to the Oracle Fabric Interconnect. Through patching, a new file can be installed on the Oracle Fabric Interconnect in a typically less intrusive manner, which also allows the Oracle Fabric Interconnect to use the new file without requiring you to completely upgrade the entire Oracle Fabric Interconnect to a new version of XgOS. In some cases, a system upgrade to a new version of XgOS might still be required, but with system patching, more flexibility is introduced into how images are installed and managed on the Oracle Fabric Interconnect, and how features and fixes are applied to the XgOS.

Note – Host drivers, InfiniBand expansion switches, and Ethernet expansion switches (for example, the ES48) do not yet support patching.

Obtain Patch Files

Patch files are made available through the Oracle Xsigo Support Portal or My Oracle Support (`http://support.oracle.com/`). To obtain one or more patches, contact Oracle Customer Support. When the patches are downloaded to the Oracle Fabric Interconnect, you will extract them.

Review Patch File Contents

Patch files are named `patch-<number>` where number is an internal identifier that is applied by Oracle. When the system is patched, an existing file on the Oracle Fabric Interconnect is replaced with a new file that you have obtained from Oracle.

Command Syntax

```
system patch <URL-to-patch.xpf>
show system patches [-detail]
show system version [-all]
show system [status]
```

Parameter Description

The `system patch` commands take the following command options:

Parameter	Description
`<URL-to-patch.xpf>`	Specifies the name of the patch file that you want to apply. Patches must be applied individually. For example, to use a patch name `patch-19408` that is located in the `patches` directory on a server named `cairo` you could issue: **system patch scp://root@cairo.xsigo.com/patches/patch-19408.xpf**
`-detail`	Is an optional argument that specifies that additional detailed information will be displayed.
`-all`	Is an optional argument that specifies that all information will be displayed.
`status`	Is an optional argument that specifies that the current status of patches will be displayed.

▼ Apply a Patch

Patching occurs on individual Oracle Fabric Interconnects. You cannot patch multiple Oracle Fabric Interconnects from one command-line session. As a result, if you have two Oracle Fabric Interconnects set up for HA, you will need to log in to one Oracle Fabric Interconnect, apply the patch, then log in to the other Oracle Fabric Interconnect, and apply the patch to that Oracle Fabric Interconnect. After patches are applied, they are immediately available. You do not need to reset any I/O Modules or reboot the Oracle Fabric Interconnect unless directed to do so by Oracle.

Patches will have patch notes available with them. Oracle strongly recommends reading the patch notes before applying the patch. If you still have questions about the patch after reading the patch notes, you can contact Oracle Customer Support.

The following procedure assume that you are using the `system patch` command. To apply a patch, follow this procedure:

1. **Get the appropriate patch from Oracle.**
2. **Issue the `system patch` command.**

   For example:

```
system patch scp://root@cairo.xsigo.com/patch-19408.xpf
```

   The `system patch` command copies the named patch file, and installs the patch to the appropriate part of the Oracle Fabric Interconnect file system.

3. **Issue the `system show patches` command to verify that the patch was successfully installed.**

▼ Remove a Patch

1. **Determine which method to use to unpatch the Oracle Fabric Interconnect:**
   - Use the `system unpatch` command.

     The system unpatch command removes a specified patch. When the patch is removed, any hot fix is no longer available and the Oracle Fabric Interconnect will return to its original configuration before the patch was applied.

     You do not need to unpatch the Oracle Fabric Interconnect to apply new patches, unless directed to do so by Oracle. Also, there is no need to reboot I/O Modules or the Oracle Fabric Interconnect after unpatching.

     When you run the system unpatch command, you must specify the name of the patch that you want to undo.

   - Upgrade back to the current version without installing the patch.

     The `system upgrade` command can be used to remove a specified patch. To remove the patch you will upgrade to the existing configuration but without the patch. For example, if you have upgraded to XgOS 3.6.0, then applied a patch, you can simply re-run the upgrade again to return to the baseline version of XgOS 3.6.0 without the patch you applied.

     To upgrade to a previous unpatched version of software, follow this procedure:

2. **To unpatch the system:**

   a. **Issue the `show system status` command or the `show system patches` command to identify the patch that you want to remove.**

b. Run the `system unpatch` command against the patch.

For example:

```
system unpatch patch-19408
```

3. To upgrade minus the patch:

a. When the downgrade is complete, upgrade again to the original version of XgOS (the version that had the patch).

For example:

```
system upgrade scp://root@cairo.xsigo.com/upgrades/xsigo-V3.8.0.xpf
```

b. Issue the `show system version` command to verify that the correct version of XgOS software is in use after the upgrade.

CHAPTER 18

Scripting XgOS Commands

The XgOS CLI scripting engine provides the Aikido scripting language, completed scripts for simplified user commands, and a full text editor for creating your own scripts. This chapter includes the following topics about scripting:

- "Scripts That Mimic UNIX Commands" on page 351
- "Aikido Scripting Language" on page 352
- "SEDIT Script Editor" on page 354
- "Create Your Own Commands" on page 355

Scripts That Mimic UNIX Commands

The XgOS CLI provides many scripts in /bin, working as simplified UNIX commands:

```
ls /bin
pwd
grep
testsuite
ls
printevents
showlog
stress
cd
cat
chmod
sedit
mkdir
rm
mv
```

Aikido Scripting Language

All onboard scripts were created using the Aikido Language System. Aikido is an interpreted, dynamically typed language that can be used for general purpose programming but is best suited for prototyping and scripting. It has been derived from the ideas present in a large number of languages including Pascal, Ada, C, C++, Java, JavaScript, and Verilog.

See `help scripts` for more information about the use of OVN scripts.

See the following sites for more information on Aikido. Specifically, the *Aikido Programming Language Reference Manual*:

http://sourceforge.net

http://en.wikipedia.org/wiki/Aikido_(programming_language)

Example: Create 10 vNICs Using Aikido

```
foreach i 10
> add vnic vnic${i}.beach 5/2
> end
```

Using the Aikido scripting language, this example creates 10 vNICs called vnic0 through vnic9 on the server-profile beach.

Example: Move and Rename Files

```
cat /bin/mv
#> Rename files
/*
 * (C) 2004,2005 XSIGO SYSTEMS Inc. All rights reserved. This material may not
 * be reproduced, displayed, modified or distributed without the express prior
 * written permission of the copyright holder.
 *
 * Author: David Allison
 * Email: dallison@xsigo.com
 *
 * $Id$
 * $Date$
 * $Revision$
 * $Author$
 *
 * Description :
 */

if (args.size() < 2) {
    throw "usage: mv file... dest"
}

var allfiles = []
for (var i = 0 ; i < args.size() - 1; i++) {
    var files = glob (args[i])
    foreach file files {
        allfiles.append (file)
    }
}

var dest = args[args.size() - 1]
var s = System.stat (dest)

var movetodir = false

if (s != null) {
    if (s.S_ISDIR()) {
        movetodir = true
    }
}

if (allfiles.size() != 1 && !movetodir) {
    throw "mv: Cannot move multiple files to a non-directory"
}
foreach file allfiles {
    println ("moving " + file + " to " + dest)
```

```
    if (movetodir) {
        var destname = dest + "/" + Filename.filename (file)
        System.rename (file, destname)
    } else {
        System.rename (file, dest)
}
}
```

SEDIT Script Editor

The Script Editor (SEDIT) is a simple but powerful onboard text editor that runs from within the CLI.

Syntax

You can use the following ways to start SEDIT and open a file:

```
sedit <filename>
file edit <filename>
vi <filename>
```

Example: Redirect CLI Output to a File and Editing the File

This example redirects (>) the output of `show system` to a file named "foo", then uses `file edit <filename>` to start the editor and open the file:

```
show system > foo
sedit foo
```

Command summary:

```
^w   write file (save)
^d   quit editor
^f   find regular expression
^g   find next
^p   for help
...
```

SEDIT runs as a script named sedit:

```
file edit /bin/sedit
```

See `help sedit` for documentation:

```
help sedit
```

▼ Create Your Own Commands

Use the Xsigo Script Editor to create your own commands (scripts) and aliases.

1. Use `file edit` to create and open a file:

```
file edit who
```

The Xsigo Script Editor starts.

2. Define the behavior.

```
1   show user
```

3. Save the file and exit the editor:

```
ctrl-w
ctrl-d
```

4. Set the file access permissions and make the file executable:

```
chmod +x who
```

5. Test the command:

```
who
-----------------------------------------------------------------
name        admin
descr
roles       administrator
```

CHAPTER 19

Source RPM: Building OVN Host Drivers

Oracle provides source RPM Package Managers (RPMs) for advanced users and developers to help support a wide array of Linux distributions. There are numerous requirements that must be satisfied in order to both compile and produce a compatible driver. The utmost of care should be taken when preparing a driver from the available source, and careful documentation should be kept in order to assist Oracle Customer Support in understanding your environment.

This chapter presents reference information and examples of using the source RPM package in the following sections:

- "Compatibility" on page 358
- "Prerequisites" on page 358
- "SRC RPM File" on page 359
- "Basic `rpmbuild` Example" on page 359
- "The SPEC File" on page 360
- "Environment Variables" on page 362
- "Build Option 1: Stock Kernels" on page 362
- "Build Option 2: Custom Kernels" on page 363
- "Build Option 3: Kernel With Upgraded OFED Stack" on page 364
- "Build Option 4: Combination of Customer Kernel and Upgraded OFED Stack" on page 365
- "Non-RPM Builds" on page 365
- "OFED Patch Files" on page 366
- "RDMA Headers" on page 367
- "InfiniBand Headers" on page 367
- "Required Information for Contacting Customer Support" on page 368

Overview

Oracle distributes two types of host driver RPMs—binary and source. Binary RPMs are compiled for a specific kernel and system architecture. Source RPMs contain the source code for building the binary package. Oracle host drivers are kernel modules. Since it is impossible for Oracle to directly support every version of Linux distribution (kernel and architecture), Oracle provides its hostdrivers as source RPMs. You compile these kernel modules against specific kernel distributions then install them as binary RPMs.

Compatibility

The source RPM has been compiled and tested with the following base Linux distributions or base kernels:

- Redhat Enterprise Linux 4, Update 8
- Redhat Enterprise Linux 5, Update 0 and later
- Redhat Enterprise Linux 6, Update 1 and later
- Generic kernels starting at 2.6.11 thru 2.6.18

Optionally, Oracle has tested and shown compatibility with updated InfiniBand (IB) drivers based on OpenFabrics Enterprise Distribution (OFED)-1.1, and OFED-1.2.X.

Oracle has tested its drivers against x86 and x86_64 architectures only.

Oracle is constantly updating its compatibility matrix to follow Open Fabrics, Kernel.org, and various Linux distributions. If you need support for a platform or distribution that is not one of the listed kernels or architectures, please contact your sales or support engineer for further information.

For the latest OFED release and install information, go to
`http://www.openfabrics.org`

Prerequisites

In addition to selecting a compatible base kernel, other requirements must be met. You should understand the origin of each of the following requirements. Some of the requirements include a base C compiler, base C Library (`libc`), kernel development

headers, kernel symbol-files, kernel config (`.config`), additional patches, updates, and fixes. In some cases, the OVN host drivers require updates or fixes in your base kernel, dependent drivers, or related tools/compilers. One example of both updated features and fixes is the `ib_mthca.ko` from pre-OFED-1.2.

Users looking to build a driver on their system should consult the target distribution's documentation on building drivers to insure that they have installed all the necessary prerequisites of the target distribution.

Please also read thru the Source RPM Release Notes for an explanation of known issues, workarounds and other common suggestions.

SRC RPM File

Oracle provides one generic source RPM for all supported kernel distributions:

```
xsigo-hostdrivers-kmod-<build>.src.rpm
```

The RPM itself is not specific to every supported Linux installation.

Basic `rpmbuild` Example

Using a basic example and all default values, the driver can be built as the root user on a Redhat Enterprise Linux 5 System:

```
# rpmbuild --rebuild xsigo-hostdrivers-kmod-linux_3.8.0-1.src.rpm
<…extensive output…>
Wrote: /usr/src/redhat/RPMS/x86_64/xsigo-hostdrivers-kmod-2.6.18-
53.el5_3.8.0-1.x86_64.rpm
Wrote: /usr/src/redhat/RPMS/x86_64/xsigo-hostdrivers-kmod-debuginfo- 2.6.18-
53.el5_3.8.0-1.x86_64.rpm
```

Note that two RPM files are built. The file containing the –debuginfo contains some of the debugging information for use with a debugger such as gdb. The other file contains the drivers, management, and startup scripts.

Then install the binary RPM:

```
# rpm -Uvh xsigo-hostdrivers-kmod-2.6.18-53.el5_3.8.0-1.x86_64.rpm
# chkconfig xsigo on
# reboot
# service xsigo status
```

The SPEC File

Often, a user will find it necessary to customize some aspect of the driver build process. Many of these behaviors are set through default environment variables, SPEC files at the top of the rpm-SPEC file, or through system scripts.

To make these customizations, you should first install the RPM source:

```
# rpm -i xsigo-hostdrivers-kmod-linux_3.8.0-1.src.rpm
```

The source files will be installed at the appropriate location as configured in your RPM program. In Redhat, this location prefix is /usr/src/redhat.

Inside this prefix directory, you will find several other directories including BUILD, RPMS, SOURCE, SPECS, and SRPMS. In the SPECS directory, you will find a file named /usr/src/redhat/SPECS/xsigo-hostdrivers.spec. You will find several SPEC variables that have initial values, and others dynamically set via scripts. You should consult the spec file for specific documentation. See the following table.

Spec File Variable	Description	Automatically Checked	Default Value	Acceptable Values
ofed1_2	The Oracle host drivers by default are written to compile against the OFED 1.1 and earlier API. By enabling this option, the drivers will be patched appropriately to enable compiling against the OFED 1.2.X distribution given the slight differences in the API. By default, this will automatically be enabled if an OFED 1.2.X installation is found as part of the kernel.	Yes	0	0 or 1

Spec File Variable	Description	Automatically Checked	Default Value	Acceptable Values
infer_ib_devel_headers	This option allows you to build the Oracle host drivers against updated OFED installations which are not part of the kernel source tree. If multiple OFED distributions are installed, then the kversion environment variable will be used. By default, this will automatically be checked and set accordingly if an OFED installation is found outside the kernel source tree.	Yes	0	0 or 1
fixup_module_symvers	Enable this option if you are building against an OFED installation which is installed outside the kernel source tree. This option is needed for kernels prior to 2.6.18 which supported finding the Module.symvers file in the top level of kernel source directory first. By default, there is no check done for this so this option must be specified by the user before building the binary RPM.	No	0	0 or 1
mthca_fix	Enable this if you would like to use the work around for the rdb_per_qp issue in the ib_mthca.ko kernel module. Otherwise, no updated ib_mthca.ko kernel module will be built. Only certain kernel versions support this since it requires the previously patched ib_mthca kernel module source code to be in the source RPM package. By default, this will be enabled if patched ib_mthca kernl module sources for the appropriate running kernel are found in the source RPM.	Yes	0	0 or 1
fmr	Enable this option if you would like to use the updated Fast Memory Registration (FMR) API. Currently, only needed on the RHEL4u5 2.6.9-55 kernel. If the 2.6.9-55 kernel is found, this option will be enabled.	Yes	0	0 or 1

Environment Variables

When building the drivers, you might need to override some default locations and values. These values are set through environment variables. See the following table.

Variable	Description
`kversion`	This environment variable can be set to specify the kernel version you would like to build the Oracle host drivers for. The default value for this is the kernel you are currently running with (e.g. `uname -r`).
`ksrc`	This environment variable can be set to point to the directory of where the kernel development headers and symbol files are located. The default directory is based on where the kernel headers are for your running kernel (e.g. `/lib/modules/${kversion}/build`).
`XSIGOFLAGS`	This environment variable can be set to specify additional flags to the compiler such as additional include paths and build parameters. Typically used to specify the additional include paths for OFED installations which are not part of the kernel source tree (e.g. `export XSIGOFLAGS=" -I/usr/src/ofa_kernel/include"`). Note that XSIGOFLAGS is automatically set through one of the external scripts when OFED is installed.

There are several build options:

- "Build Option 1: Stock Kernels" on page 362
- "Build Option 2: Custom Kernels" on page 363
- "Build Option 3: Kernel With Upgraded OFED Stack" on page 364
- "Build Option 4: Combination of Customer Kernel and Upgraded OFED Stack" on page 365

Build Option 1: Stock Kernels

Source RPMs are available by request from Oracle Customer Support. If you will be building a source RPM, contact Oracle Customer Support, who will provide instructions for obtaining the image and can provide assistance with using the source. You will need to provide Oracle Customer Support with some basic information For more information, see "Required Information for Contacting Customer Support" on page 368.

Be aware of the following:

- Tested environments: RHEL4, RHEL5

- Dependencies: kernel-devel RPM

In this scenario, all of your kernel source and devel-headers/objects should be located inside the path /lib/modules/`uname -r`/build. This symbolic link is the default location for the xsigo-hostdriver src-rpm to look for the kernel source directory.

Command sequence procedure:

```
# rpm -ivh xsigo-hostdrivers-kmod-linux_<#version>-1.src.rpm
# rpmbuild -bb /usr/src/redhat/SPECS/xsigo-hostdrivers.spec
```

Build Option 2: Custom Kernels

Source RPMs are available by request from Oracle Customer Support. If you will be building a source RPM, contact Oracle Customer Support, who will provide instructions for obtaining the image and can provide assistance with using the source. You will need to provide Oracle Customer Support with some basic information For more information, see "Required Information for Contacting Customer Support" on page 368.

Be aware of the following:

- Tested Environments: 2.6.16, 2.6.18.1 (mainline)
- Dependencies: Complete compiled kernel tree

When compiling your own kernel and drivers, you will need to retain both the kernel source tree and some of the binary files. Often, when you install your kernel, it will make the symbolic link /lib/modules/`uname -r`/build. If this is not the case, you will need to export the location of the kernel prior to running rpmbuild.

Command sequence procedure:

```
# rpm -ivh xsigo-hostdrivers-kmod-linux_<#version>-1.src.rpm
# export ksrc=/root/linux-2.6.18.1
# rpmbuild -bb /usr/src/redhat/SPECS/xsigo-hostdrivers.spec
```

This procedure will override the default kernel location.

Build Option 3: Kernel With Upgraded OFED Stack

Source RPMs are available by request from Oracle Customer Support. If you will be building a source RPM, contact Oracle Customer Support, who will provide instructions for obtaining the image and can provide assistance with using the source. You will need to provide Oracle Customer Support with some basic information For more information, see "Required Information for Contacting Customer Support" on page 368.

Be aware of the following:

- Tested Environments: 2.6.16.21 + OFED-1.2, 2.6.16.21 + OFED-1.1, RHEL4 + OFED-1.1
- Dependencies: Compiled kernel source trees and updated OFED headers

Replacing the InfiniBand driver stack with an updated OFED stack can and likely will result in API changes for the drivers. It is likely that you will need to modify the existing native InfiniBand calls to conform to the current headers. In order to have kbuild look in the proper location for the InfiniBand stack, you will need to set the environment variable XSIGOFLAGS. This modifies the search path when kbuild is compiling to look for the header files before looking in the default kernel source directory.

Command sequence procedure:

```
# rpm -ivh xsigo-hostdrivers-kmod-linux_<#version>-1.src.rpm
# export XSIGOFLAGS=" -I /usr/src/ofa_kernel-1.2.5.1/include "
# rpmbuild -bb /usr/src/redhat/SPECS/xsigo-hostdrivers.spec
```

A suggestion to find the proper include path is to find the "include/rdma" directory in your build tree:

```
# find /root/ofed-1.2.5 -name rdma
/root/ofed-1.2.5/include/rdma
```

In this scenario, you want to set XSIGOFLAGS to this:

```
# export XSIGOFLAGS=" -I /root/ofed-1.2.5/include "
```

Build Option 4: Combination of Customer Kernel and Upgraded OFED Stack

Source RPMs are available by request from Oracle Customer Support. If you will be building a source RPM, contact Oracle Customer Support, who will provide instructions for obtaining the image and can provide assistance with using the source. You will need to provide Oracle Customer Support with some basic information For more information, see "Required Information for Contacting Customer Support" on page 368.

Often, users will have both a custom kernel and an upgraded OFED stack. It is important to make sure the following requirements are met:

1. The symbolic link `/lib/modules/`uname -r`/build` correctly points to the kernel source tree.
2. Alternately, you can override the default kernel tree location by setting the `ksrc` environment variable.
3. Set the `XSIGOFLAGS` environment variable to the appropriate path for the correct OFED header path.
4. Make sure you work out the work queues and C syntax (typically set by kernel version) and that the headers/API match the IB-API of the Oracle drivers. Some combinations are included with patches.

Command sequence procedure:

Non-RPM Builds

```
# rpm -ivh xsigo-hostdrivers-kmod-linux_<#version>-1.src.rpm
# export ksrc='/root/linux-2.6.18.1'
# export kversion='2.6.18.1' (This value often matches uname -r)
# rpmbuild -bb /usr/src/redhat/SPECS/xsigo-hostdrivers.spec
```

While Oracle intends their drivers to be installed on a system which leverages the RPM (Redhat Package Manager), it is still possible for advanced users to extract the source code and build each driver manually.

When you do this, you should also take care to include the appropriate xsigod userland configuration application and startup scripts.

Here is a command sequence to build the 1.5 drivers manually from the src-RPM file:

```
# rpm2cpio xsigo-hostdrivers-kmod-linux_3.8.0-1.src.rpm|cpio -iud
# tar xzvf xsigo_branch_3.8.0.tar.gz
# make -C/lib/modules/`uname -r`/build  M=`pwd`/ksrc/xsigoib
# make -C/lib/modules/`uname -r`/build  M=`pwd`/ksrc/xcpm
# make -C/lib/modules/`uname -r`/build  M=`pwd`/ksrc/vnic
# make -C/lib/modules/`uname -r`/build  M=`pwd`/ksrc/vhba
# make -C/lib/modules/`uname -r`/build  M=`pwd`/ksrc/kxsigod
# mkdir -p /lib/modules/`uname -r`/updates/kernel/drivers/kxsigod/ulp
# cp ksrc/*/*.ko /lib/modules/`uname -r`/updates/kernel/drivers/ulp
# depmod -a
# cp scripts/xsigo /etc/init.d/xsigo
```

Activate the `init.d` script.

```
# make -C apps/xsigod
# cp apps/xsigod/xsigod /usr/bin/xsigod
```

OFED Patch Files

The patch program takes a patch file containing a difference listing produced by the `diff` program and applies those differences to one or more original files, producing patched versions.

Oracle uses two patches:

1. `xsigo-linux-2.6.9-55.patch` is used to handle a change in ib_fmr_pool_map_phys API in xsigoib/xsigoib.c
2. `ofed-1.2.patch` is used to handle changes in OFED 1.2 as compared with Xsigo's source code base and affects a number of files.

The patches are normally invoked as part of Xsigo's spec file. If they need to be manually applied, invoke the patch program.

Example:

```
patch <<ofed-1.2.patch>
```

Note the first < is part of the command and the <> denotes the file name.

RDMA Headers

To support installing the Oracle Source RPM on RHEL4u4, you might be required to add source RPM RDMA headers.

▼ Add RDMA Headers

If you need to add the RDMA headers, you can do so by performing the following steps:

1. **Install the matching kernel source RPM.**
2. **Issue the following command:**

```
rpmbuild -bp --target<i686|x86_64> /usr/src/redhat/SPECS/<kernel spec file>
```

3. **Issue the following command:**

```
cp -r /usr/src/redhat/BUILD/drivers/infiniband/include/usr/scr/kernels/<kernel>
/drivers/infiniband/
```

InfiniBand Headers

RHEL4 kernel-devel packages do not include all the requisite InfiniBand headers. Oracle has included the missing headers in the `source-RPM` file, which can be extracted and added to the compiler include path through the XSIGOFLAGS variable. Or, you can copy them manually:

```
cp /usr/src/redhat/SOURCES/rhel4_headers.tar  /usr/src/kernels/<kernel>/
cd /usr/src/kernels/<kernel>/
tar xvf rhel4_headers.tar
tar zxvf <kernel>.tgz
```

If running against a OFED-1.2.5.X IB stack, the following kernel log message (`dmesg`) is benign:

```
ib_cm: req timeout_ms 16896 > 8192, decreasing
ib_cm: req remote_cm_response_timeout 22 > 21, decreasing
ib_cm: req local_cm_response_timeout 22 > 21, decreasing It can be eliminated by
setting max_timeout ib_cm module parameter to 23.
```

Required Information for Contacting Customer Support

Before contacting Oracle Customer Support, gather the following information about how you are using/building the drivers:

- The base kernel origin (is it RHEL/kernel.org, compilers, the .config, etc)
- Any modifications to the OVN drivers and specs.
- A brief description of the build process you are using.
- Any custom hardware, firmware, or custom loading of the drivers.
- Any SAN-boot or related configuration/initrd/ information (how did you install the image to SAN, etc)

You can contact Customer Support through email, telephone, or web request as documented in "Support and Accessibility" on page xxvi.

CHAPTER 20

Upgrading XgOS

This section provides information of upgrading the XgOS software on the Oracle Fabric Interconnect. It contains the following major sections:

- "XgOS Upgrade Overview" on page 369
- "Basic OS Upgrade" on page 371
- "Xsigo Dependency Service" on page 384
- "High Availability System Upgrade" on page 385

XgOS Upgrade Overview

- "Understanding XgOS Upgrade" on page 369
- "Saving and Restoring Your Configuration" on page 370
- "Selecting an Upgrade Procedure" on page 371

Understanding XgOS Upgrade

The XgOS software image is a Xsigo Package File (XPF) file. When you upgrade XgOS, you use the `system upgrade` command and supply a URL which is the path for the XPF file.

The upgrade procedure for XgOS supports the following upgrade options:

- HTTP
- secure http (HTTPS)
- secure copy (SCP)

- file, for upgrading from a file that has already been downloaded to the Oracle Fabric Interconnect. This option is useful for upgrading the Fabric Interconnect from a local file system, for example from disk, USB (a mounted `/usb` device), or a `/home` directory.
- ftp. Upgrade through FTP prompts you for a password.

You can also perform upgrades in confirmation or non-confirmation mode by using the `-noconfirm` argument in the `system upgrade` command. The `-noconfirm` argument is optional, and the behavior of prompts is different depending on whether you use this argument:

If you specify the `-noconfirm` argument, the upgrade completes without prompting you for confirmation. The `-noconfirm` argument automatically answers yes to any prompts.

If you do not specify the `-noconfirm` argument, you will be prompted for a yes or no answer as needed during the upgrade.

Saving and Restoring Your Configuration

The Oracle Fabric Interconnect automatically maintains a copy of its current configuration at all times. Also, it is possible to save and restore the configuration on demand. Although not required, it is a good practice to create a backup of the current configuration in case you encounter any problems during the upgrade process.

- To save the current configuration, use the `system export <file-name>` command. For example, to save the current running configuration to a file called `xsigo-3.9.0.xml`, you would issue the command as follows:

  `system export xsigo-3.9.0.xml`

- To restore the configuration from a backup, use the system import <file-name> command to load the saved configuration. For example, to load the saved configuration called `xsigo-3.9.0.xml`, you would issue the command as follows:

  `system import xsigo-3.9.0.xml`

  The file will be imported from the current directory unless you provided a path and filename when you exported the file. If you exported the configuration to a path and file name, make sure you specify the path and file name when you import the saved configuration.

Note – When importing a backed-up configuration, it is very important that the hardware configuration on the Oracle Fabric Interconnect match the hardware configuration when the XML file was exported. If the two do not match, the import will abort.

Exporting your configuration is not required before upgrading. If you use the `system export <file-name>` command, the file is exported to XML format (the default format) to the `/home` directory of whichever user account you used to log in. For example, if you logged in as `admin`, the XML configuration would be in `/home/admin`. The configuration can then be re-imported from that directory.

Selecting an Upgrade Procedure

This guide presents the following upgrade procedures. Each is designed to support a specific type of Oracle Fabric Interconnect configuration. Select the procedure that suits your system configuration:

- "Basic OS Upgrade" on page 371 provides procedures for upgrading a system that has a management network.
- Chapter 2, "Upgrading a High Availability System," provides procedures for upgrading a system that uses a vNIC for the management connection.

Basic OS Upgrade

If you are not using a vNIC for your management connection, use the procedures in this chapter to upgrade your systems. This section contains the following procedures:

- "Basic Upgrade Process" on page 372
- "Upgrade OS on the Oracle Fabric Interconnect" on page 373
- "Upgrade Linux Host Servers That Boot Locally" on page 376
- "Upgrading Linux Hosts In a SAN Boot Environment" on page 379
- "Upgrading VMware Host Servers" on page 379
- "Upgrade VMware Host Servers" on page 380
- "Upgrading Windows Host Servers" on page 381

Basic Upgrade Process

If you are upgrading from XgOS 3.5.0 to XgOS 3.6.0 or later, you do not need to keep the Oracle Fabric Interconnectr software and host driver software in exact synchronicity. In fact, XgOS software and host driver software can be upgraded independent of each other. However, you should keep the XgOS software and the host driver software reasonably in sync. For example, running 3.6.0 XgOS with 3.5.0 Xsigo host driver software provides you with a more optimized environment than running Xsigo 3.6.0 XgOS with 2.8.5 Xsigo host drivers.

To minimize service interruption, use the following process to upgrade your systems:

1. **Upgrade the OS on one Oracle Fabric Interconnect.**

   While this upgrade is in process, servers that use this Oracle Fabric Interconnect. as their primary vNIC connection fail over to using their secondary vNIC. This way, they are isolated from the newer software for which their drivers are possibly not compatible.

   Follow the steps in "Upgrade OS on the Oracle Fabric Interconnect" on page 20-373 to upgrade the OS on the primary Fabric Director.

2. **Upgrade the host drivers, the HCA firmware, and possibly the option ROM on each server.**

   After you upgrade each server, it reboots. When it comes back up, it re-establishes a connection to its primary vNIC. This way, the server is now connected to an Oracle Fabric Interconnect with a new XgOS using upgraded (and therefore compatible) host drivers.

   Follow the steps in one of the following procedures to upgrade each of your host servers:

   - "Upgrade Linux Host Servers That Boot Locally" on page 20-376
   - "Upgrading Linux Hosts In a SAN Boot Environment" on page 379
   - "Upgrade VMware Host Servers" on page 20-380
   - "Upgrading Windows Host Servers" on page 20-381

3. **Once all servers are upgraded, upgrade the OS on the second Oracle Fabric Interconnect.**

   Follow the steps in "Upgrade OS on the Oracle Fabric Interconnect" on page 20-373 to upgrade the OS on the secondary Oracle Fabric Interconnect.

You should read the complete upgrade instructions before attempting any system upgrade. For information about upgrading Oracle's Fabric Manager, see the *Oracle Fabric Manager User's Guide*.

▼ Upgrade OS on the Oracle Fabric Interconnect

1. **Log in to the Oracle Fabric Interconnect as** `admin`**.**

2. **(Optional) If any other administrators are likely to be connected to your Oracle Fabric Interconnect, issue a system broadcast to warn them to disconnect:**

```
system broadcast Upgrading the Fabric Interconnect in 2 minutes!
```

3. **Save your current configuration:**

```
system export xgos-3.9.0.xml
```

   Where `xgos-3.9.0.xml` is the existing configuration file.

4. **Issue the** `system upgrade` **command and supply the full path to the new system image.**

   For example, assume the following:

   - the new system image is named `xgos-3.9.2.xpf`
   - the new system image is on a server named “cairo” in the `xsigo/upgrades` directory

   The following examples show how to issue the `system upgrade` command for each of the supported upgrade types:

   - Using HTTP or HTTPS, type either of the commands:

```
system upgrade http://cairo.xsigo.com/upgrades/xgos-3.9.2.xpf
system upgrade https://cairo.xsigo.com/upgrades/xgos-3.9.2.xpf
```

   - Using SCP, type:

```
system upgrade scp://root@cairo.xsigo.com/upgrades/xgos-3.9.2.xpf
```

     If you upgrade using SCP, you will be prompted for a password.

   - Using file name, when the XPF is already on the Fabric Interconnect, type:

```
system upgrade file:///upgrades/xgos-3.9.2.xpf
```

     In cases where you are using local upgrade through the `file` command, you can pull the XPF file to the Fabric Interconnect by using the `file copy` command. Also, local upgrade occurs by default if you omit a remote host in the system upgrade command.

- Using FTP, type:

```
system upgrade ftp://root@cairo.xsigo.com/upgrades/xgos-3.9.2.xpf
```

If you upgrade using FTP, you will be prompted for a password.

Note – If you get the this error message during the upgrade, `Installation failed (Unable to unpack package file xsigo-3.9.2.xpf,` issue the `system clear garbage` command to remove any partial or failed installs.

When you issue the `system upgrade` command, the Fabric Interconnect begins the upgrade. While the upgrade occurs, status messages are displayed, as shown in the following example:

```
Copying...############################################################ [100%]
You have begun to upgrade the system software.  Please be aware that this will
cause an I/O service interruption and the system may be rebooted.
The following software will be installed
 1. XgOS Operating System software including SCP Base OS
 2. XgOS Front-panel software
 3. XgOS Common Chassis Management software on IOC
 4. XgOS VNIC Manager and Agent software
 5. XgOS VN10G and VN10x1G Manager and Agent software
 6. XgOS VHBA and VHBA-2 Manager and Agent software
 7. XgOS VN10G and VN10x1G Manager and Agent software with Eth/IB Interfaces
 8. XgOS VHBA-3 Manager and Agent software
 9. XgOS VHBA 2x 8G FC Manager and Agent software
 10. HCA's Firmware and Option ROM
Are you sure you want to update the software (y/n)? y
Running verify scripts...
Running preunpack scripts...

Installing...       ################################################ [100%]
Verifying...        ################################################ [100%]
Running preinstall scripts...
The installer has determined that a cold restart of the Director is necessary
Installing package...
Running postinstall scripts...
```

At this point, the Fabric Interconnect will restart, and you will be logged out. Wait for a few minutes so that the Fabric Interconnect can complete its reboot, then log in. When the Fabric Interconnect is rebooting, reboot ESX Server 1.

The Fabric Interconnect will take approximately 2 minutes to reboot, but approximately 10 minutes for I/O cards, virtual resources, and all related services to come back up and restore service.

5. **Wait for the I/O cards in the Fabric Interconnect to finish initializing before proceeding.**

   To determine whether the I/O cards are initialized, use the `show iocard` command. The Fabric Interconnect displays the state of all cards. When the state of the cards is `up/up`, you are ready to proceed.

6. **When the I/O cards all show `up/up`, check the state of the vNICs and vHBAs:**

```
show vnic *
show vhba *
```

   The state of the vNICs and vHBAs should be `up/up`.

7. **When all vNICs and vHBAs in the Fabric Interconnect have come to `up/up` state, log in to the host server.**

8. **On the host server, verify that all the vNICs and vHBAs have reconnected and returned to `up/up` state.**

   For example, on an ESX Server:

```
esxcfg-mpath -l
fc.5001397100002505:5001397000002505-
fc.2001000b08002539:2400000b08043110-eui.00
0b080074002539
 Runtime Name: p3:C0:T0:L2
 Device: eui.000b080074002539
 Device Display Name:Pillar Fibre Channel Disk
(eui.000b080074002539)
 Adapter: p3 Channel: 0 Target: 0 LUN: 2
 Adapter Identifier: fc.5001397100002505:5001397000002505
 Target Identifier: fc.2001000b08002539:2400000b08043110
 Plugin: NMP
 State: active
  :
  :
```

   When the `State` field shows `active`, the vHBA is up and connected.

9. **When the Fabric Interconnect has completed its restart, verify that the new software has been installed:**

```
show system version
Build 3.6.0-XGOS  - (root) Thu Jul 21 23:39:53 UTC 2011
```

While the first Fabric Interconnect was unavailable, host servers that were using it failed over to use the other Fabric Interconnect for their I/O. Assuming that you do not have automatic switchover configured, they will remain with that Fabric Interconnect until they reboot after receiving their host driver upgrade.

If this is your first Fabric Interconnect, the next task is to upgrade the host drivers, HCA firmware, and the option ROM for each host server. See the following procedures:

- "Upgrade Linux Host Servers That Boot Locally" on page 20-376
- "Upgrading Linux Hosts In a SAN Boot Environment" on page 379
- "Upgrade VMware Host Servers" on page 20-380
- "Upgrading Windows Host Servers" on page 20-381

If this was your second Fabric Interconnect you have completed the upgrade process. If you are using Oracle's Fabric Interconnect, upgrade the standalone software packages by uninstalling the older software and installing the new software. Refer to the installing Fabric Interconnect section in the *Oracle Fabric Manager User's Guide*.

▼ Upgrade Linux Host Servers That Boot Locally

1. **Check the firmware and option ROM level:**

   a. **Log in as root to the host server.**

   b. **Run** `xg_config` **to view the firmware and option ROM levels.**

```
/opt/xsigo/bin/xg_config
################################################################
# Main Menu
################################################################
Selected card:
 Node GUID          : '0002:c902:0020:4934'
 Board ID           : 'MT_0150000001'
 CA type            : 'MT25208'
 Firmware version   : '5.3.0'
 Hardware version   : 'a0'
Option ROM version : 'XgBoot Version 2.8.7'
```

Version 3.6.0 of XgOS supports the following firmware levels:

- InfiniHost, Single Port HCA: 1.2.0
- InfiniHost Dual Port HCA: 5.3.0

- ConnectX and ConnectX-2: 2.7.0 and later

It requires option ROM 2.8.7 to support SAN boot. If your firmware and XgBoot versions are as shown above, you can skip Step 2.

2. On your Linux host server, upgrade the HCA firmware and the option ROM if necessary.

a. If you haven't already done so, log in as `root` to the host server.

b. Upgrade the Xsigo HCA firmware package on the server.

```
rpm -Uvh <xsigo-hca-firmware_2.8.7.i386.rpm>
```

Note – Replace `xsigo-hca-firmware_2.8.7.i386.rpm` with the Xsigo host driver for your server. Supported host drivers for each operating system are listed in the release notes.

---

c. Run `xg_config` to upgrade the firmware and option ROM.

```
/opt/xsigo/bin/xg_config
################################################################
# Main Menu
################################################################
Selected card:
 Node GUID          : '0002:c902:0020:4934'
 Board ID           : 'MT_0150000001'
 CA type            : 'MT25208'
 Firmware version   : '5.3.0'
 Hardware version   : 'a0'
Option ROM version : 'XgBoot Version 2.8.7'
1) Flash HCA Firmware
2) Flash HCA Firmware + Option ROM
3) Flash Option ROM
4) Change selected card
0) Quit
Select option>
```

d. If you are using SAN boot or might decide to in the future, select option 2. Otherwise, select option 1.

In the following screen output example, option 2 was selected:

```
################################################################
# Flash HCA Firmware + Option ROM Menu
################################################################
Selected card:
 Node GUID          : '0002:c902:0020:4934'
```

```
 Board ID           : 'MT_0150000001'
 CA type            : 'MT25208'
 Firmware version   : '5.3.0'
 Hardware version   : 'a0'
 Option ROM version : 'XgBoot Version 2.8.7'

1) 5.2.0 (XgBoot Version 2.8.7)
2) 5.1.400 (XgBoot Version 2.8.7)
0) Return to previous menu
Select firmware to use>
```

e. Select the most recent firmware (the one displayed first).

You will need to reboot for the firmware upgrade to take effect. However, you can wait to reboot until you have upgraded the host drivers.

XgOS version 3.9.0 requires support for OFED 1.5.3 or newer for Red Hat Enterprise Linux 6u1, Citrix 5.6, and Citrix 5.6 SP2.

The next steps install that IB stack, if you need it, and the Xsigo host driver.

3. Check for the OFED rpm on your system.

For example, if you are using RedHat Linux 5 Update 6:

```
rpm -qa | grep kernel-ib kernel-ib-1.3.1-2.6.11_238.ELsmp.i386.rpm
```

4. On your server, install the OFED rpm:

```
rpm -Uvh </path/to/driver.rpm>
```

For example, to install the rpm for RedHat Linux 5 Update 6:

```
rpm -Uvh /opt/xsigo/kernel-ib-1.3.1-2.6.11_238.ELsmp.i386.rpm
```

5. On your host server, update the host driver package:

```
rpm -Uvh </path/to/driver.rpm>
```

For example:

```
rpm -Uvh
  /opt/xsigo/xsigohhostdrivers-kmod2.6.11_238.ELsmp.i386.rpm
```

6. Confirm that the host driver package has been updated.

```
rpm -qa | grep xsigo
  /opt/xsigo/xsigohhostdrivers-kmod2.6.11_238.ELsmp.i386.rpm
```

7. **Reboot the server.**

This completes the Linux host server upgrade. If you have more servers to upgrade, complete that task now. If you have upgraded all servers, proceed to "Upgrade OS on the Oracle Fabric Interconnect" on page 20-373 to upgrade your second Fabric Director's operating system.

Upgrading Linux Hosts In a SAN Boot Environment

When your server boots across the storage network, you upgrade the drivers by replacing the `initrd` or `initramfs` depending on the version of Linux OS running on the host. The `initrd` or `initramfs` is replaced in the `/boot` partition with the new initrd containing the updated drivers. Then reboot the server to load the new drivers. For more information about installing the Xsigo `initrd`, see the SAN boot section in the *XgOS Remote Booting Guide.*

Upgrading VMware Host Servers

Before you begin the XgOS upgrade, migrate all virtual machines from this server to another. You migrate the VMs in any of the following ways:

- Drag and drop the VMs through the Virtual Infrastructure Client.
- Put the ESX server into maintenance mode, and the VMs are automatically evacuated.
- Manually migrate multiple virtual machines:

  a. **Use Virtual Infrastructure Client to connect to VirtualCenter Server.**

  b. **In Inventory View, go to Host & Clusters, Virtual Machines Tab.**

  c. **Highlight each powered up virtual machine that you want to VMotion, right-click and select "Migrate."**

     This will bring up the Migrate Wizard.

  d. **Follow the Migrate Wizard prompts to complete the VMotion move.**

Compatible Software Versions

When upgrading a VMware host server, be aware of the particular versions of ESX server software and Xsigo host drivers required. Host drivers for each supported operating system are listed in the release notes.

Caution – Make sure to select the compatible pair of drivers. If you attempt to install an incompatible Xsigo driver after installing the Infiniband driver, you will receive an error message

▼ Upgrade VMware Host Servers

1. **Copy the host driver package to your system. The Xsigo host driver package contains both the InfiniBand stack and the Xsigo host drivers.**

   For example, the following command illustrates copying the package using `scp`:

   `scp` </path/to/driver.zip> **`user@host:/mydriv`**e

2. **Check the version of the drivers installed on the system.**

```
esxupdate query
---Bulletin ID----------  Installed----- --------------Summary-----
ESX410-Update01            2011-07-14T12:53:00   VMware ESX 4.1 Complete Update
XSIGO-4.1.0.260247.3.5.0-1 2011-07-19T09:31:18   Xsigo Systems Virtual Driver +
IB Bundle
```

3. **Remove the Xsigo drivers package:**

```
esxupdate remove -b <bulletin-ID>
```

4. **Install the new Xsigo drivers package:**

```
esxupdate update --bundle <xsigo.zip>
```

5. **Confirm that the updated packages have been installed:**

```
esxupdate query
---Bulletin ID----------  Installed----- --------------Summary-----
ESX410-Update01            2011-07-14T12:53:00   VMware ESX 4.1 Complete Update
XSIGO-4.1.0.260247.3.6.0-1 2011-07-19T09:31:18   Xsigo Systems Virtual Driver +
IB Bundle
```

6. **Reboot the VMware server.**

This completes the VMware host server upgrade. If you have more servers to upgrade, complete that task now. If you have upgraded all servers, proceed to "Upgrade OS on the Oracle Fabric Interconnect" on page 20-373 to upgrade your second Fabric Interconnect's OS.

Upgrading Windows Host Servers

When using vNICs in an HA configuration, system `.DLL` files are in use. This prevents the upgrade process from accessing the `.DLL` files needed for upgrade. To upgrade the Windows host drivers from 3.5.0 to 3.6.0 using HA vNICs, it is best if you first uninstall the previous version of host drivers, restart your Windows host, and then proceed with a clean installation of the Windows host drivers. Follow the instructions in the *Fabric Interconnect Hardware and Drivers Installation Guide*.

▼ Upgrading Windows Host Servers

In release 3.6.0, host driver upgrade is not supported. Instead, uninstall the old drivers and then install the new ones as follows:

1. **Log in to the Windows server as administrator.**
2. **Get the updated Xsigo software.**

   Either download the software from the support site or put the CD into the drive.
3. **Extract the software archive to any directory.**

Note – Be sure to completely extract the software to a folder. Do not attempt to install the drivers from a compressed folder.

---

4. **Open a command prompt by clicking Start>Run> and entering** `cmd`**.**
5. **Change directory to the location of your existing Xsigo software.**

   For example: `cd D:\xsigo`
6. **Run the** `setup.exe` **and follow the instructions for removing the Xsigo host drivers.**
7. **Reboot the server.**
8. **Change directory to the location of your 3.6.0 system software**
9. **Run the setup.exe and follow the instructions for installing the new Xsigo host drivers.**
10. **If this server supports services that depend on storage that is accessed across vHBAs, configure dependencies for those services by issuing the following command:**

```
sc config <serviceName> depend= xgdependroot
```

Note – The space following the equals sign (=) is mandatory.

This command causes the service to delay its start until LUNs are available across the vHBA. For the details of the XgDependRoot service, see "Xsigo Dependency Service" on page 384.

▼ Upgrading Windows HCA Firmware and Option ROM

XgOS supports the following firmware levels:

- InfiniHost Single Port HCA: 1.2.0
- InfiniHost Dual Port HCA: 5.3.0
- ConnectX and ConnectX-2: 2.7.0 and later

When the `Xg_FWUpdate.vbs` script runs, it first checks the current HCA Device ID and firmware level and determines if an update is required.

1. To run the script, start a command prompt by following ***Start->Run...***.
2. **Change directory to** `%programfiles%\Xsigo Systems\Support\FirmwareUpdate`.

```
cd %programfiles%\Xsigo Systems\Support\FirmwareUpdate
```

`This` is the directory where the HCA firmware update script is located.

3. **From the prompt, run the script by issuing the following command:**

```
cscript Xg_FWUpdate.vbs

Microsoft (R) Windows Script Host Version 5.6
Copyright (C) Microsoft Corporation 1996-2001. All rights
reserved.
  :
#####################################################################
# Main Menu
#####################################################################
Selected HCA Card Number: 0
HCA Device ID : mt25218_pciconf0
Image Type : failsafe
I.S. Version : 1
Device ID :
Chip Revision : a0
```

```
GUID Descr : node port1 port2 sys image
GUIDs : 0002c9020021f1f0 0002c9020021f1f1 0002c9020021f1f2
0002c9020021 f1f3
BOARD ID : mt_0370110001
VSD :
PSID : mt_0370110001
FW Version :
HCA mlx FW Ver : 5.1.400
1) Flash HCA Firmware
2) Change selected card
0) Quit
Select option>
```

4. When prompted, enter 1 to enter the Flash HCA Firmware Menu.

```
Select option> 1
######################################################################
# Main Menu
######################################################################
Selected HCA Card Number: 0
HCA Device ID : mt25218_pciconf0
Image Type : failsafe
I.S. Version : 1
Device ID :
Chip Revision : a0
GUID Descr : node port1 port2 sys image
GUIDs : 0002c9020021f1f0 0002c9020021f1f1 0002c9020021f1f2
0002c9020021 f1f3
BOARD ID : mt_0370110001
VSD :
PSID : mt_0370110001
FW Version :
HCA mlx FW Ver : 5.1.400
1) 5.2.0
2) 5.1.400
0) Return to previous menu
Select Firmware to Burn>
```

5. When prompted, select the firmware version that you want to burn onto the HCA in the Windows server.

Note – Do not attempt to abort the firmware upgrade process after it has started.

The following example shows updating the HCA with firmware version 5.2.0.

```
Select Firmware to Burn> 1
Upgrading HCA firmware 5.1.400 to 5.2.0
This Will Flash HCA with Firmware file .\Image\fw-25218-5_2_0-
mhea28-xtc_a1-a2.bin
Please do not interrupt the burn process or reboot the machine...
Wait till burn completes ...
.....................................................................
---------------------------------------------------------------------
The firmware on one or more of the HCAs has been upgraded.
It is recommended to reboot the machine in order for changes to
take effect.
---------------------------------------------------------------------
Press Enter key to continue
```

6. **Press Enter to exit the update script**

Note – Whenever you run the script and burn firmware on one or more HCAs, shut down the Windows server and then start it to bring HCAs up.

---

7. **If HCAs have been updated, this cold boot is required bring them online with the new firmware.**

This completes the Windows host server upgrade. If you have more servers to upgrade, complete that task now. If you have upgraded all servers, proceed to "Upgrade OS on the Oracle Fabric Interconnect" on page 20-373 to upgrade your second Oracle Fabric Interconnect OS.

Xsigo Dependency Service

The Xsigo dependency service, XgDependRoot, delays the services that depend upon it for 60 seconds. Setting a dependency on this service allows the dependent service to wait for the LUNs presented by the vHBA to be up and ready for use.

Setting the Dependency of Other Services Upon XgDependRoot

For Windows shares that do not come up after the host is rebooted, run this command after installing the Xsigo drivers.

For example, for `lanmanserver` (the server service):

```
sc config lanmanserver depend= xgdependroot
```

Note – The space following the equals sign (=) is required.

To set the dependency of another service, substitute its name for `lanmanserver` in the example above. For example, use `iisadmin` if the web site or FTP site is residing on a vHBA LUN.

After you have installed the drivers and set the dependency, reboot the server.

Removing Dependencies Manually

To remove all dependencies from a service, set the dependencies to an empty string, For example, to remove dependencies from `lanmanserver`:

```
sc config lanmanserver depend= ""
```

Removing Xsigo Drivers and Any Dependencies

Uninstalling the Xsigo Drivers removes all dependencies placed upon the service during the uninstall process.

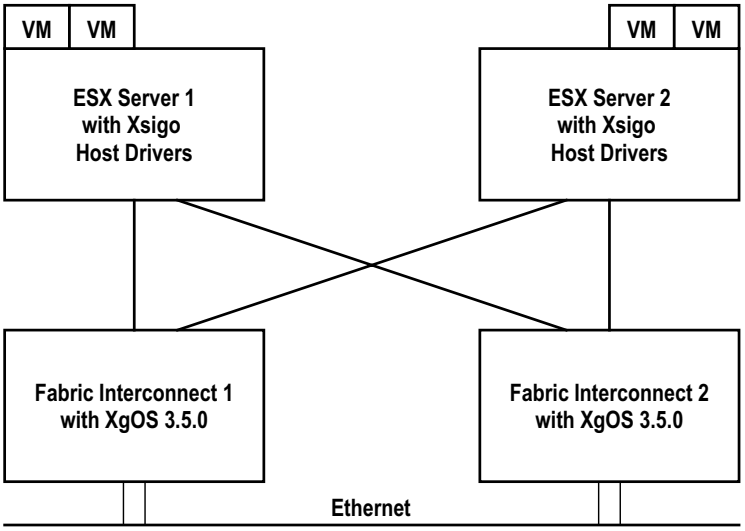
High Availability System Upgrade

This section provides upgrade procedures used when your configuration has a vNIC for its management connection. It assumes that you are using the Oracle Fabric Interconnect in a specific high availability configuration. It contains the following sections:

- "High-Availability Upgrade Process" on page 385
- "Upgrade First ESX Sever and Fabric Interconnect" on page 387
- "Upgrade Second ESX Server and Fabric Interconnect" on page 392

High-Availability Upgrade Process

This process assumes that you have the configuration shown in the figure.



You must upgrade one ESX Server and one at a time. After they reboot running the new software version, you will use VMotion to move all guest machines to the upgraded server and upgrade the second ESX Server and Fabric Interconnect. In the procedures that follow, ESX Server 1 and Fabric Interconnect 1 are upgraded first. You can select whichever server and Fabric Interconnect makes sense for your system.

The upgrade procedures show an upgrade from XgOS version 3.5.0 to XgOS version 3.6.0 and to version 3.5.0 host drivers. The steps to upgrade are applicable to nearly all upgrades between versions of XgOS and host driver, and to all XgOS software of version 3.6.0 or later. However, there might be syntax differences between different versions of host operating systems. In the example used for this procedure, the example package names and versions may be different than what is in use in your environment.

You do not need to keep the latest version of host drivers synchronized with the latest version of XgOS, but it's best to keep the host drivers and XgOS versions close in terms of upgrades. For example, you would not want to use version 2.8.0 host drivers and version 3.6.0 XgOS due to the availability of new features, enhancements, and other optimizations that are present in newer host drivers.

Note – You can download the latest supported host drivers from Oracle's Xsigo Customer Support site. Refer to the Release Notes for download instructions.

Compatible Software Versions

You will typically need different host drivers depending on your version of ESX Server software and the HCAs in your servers. When upgrading a VMware host server, be aware of the particular versions of ESX server software and Xsigo host drivers required. Host drivers for each supported operating system are listed in the Release Notes.

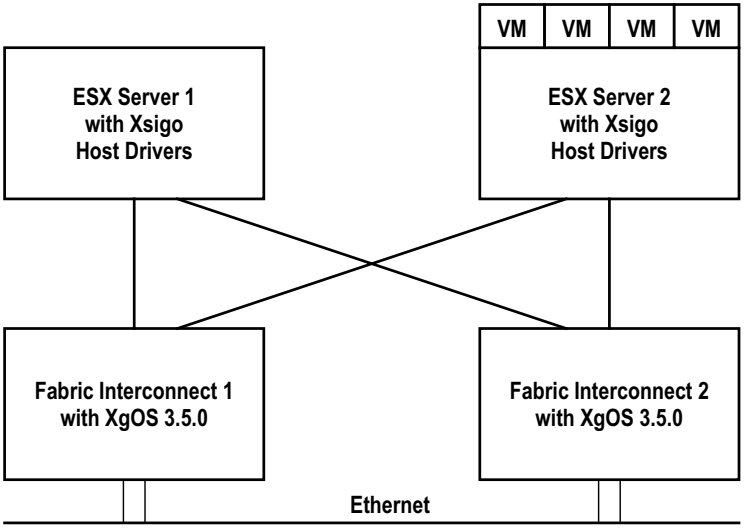
▼ Upgrade First ESX Sever and Fabric Interconnect

Use these steps to upgrade the ESX Server 1 host drivers and XgOS on Fabric Interconnect 1:

1. **Log in to ESX Server 1.**

2. **Use VMotion to move all guest machines off of ESX Server 1.**

When you have finished, your system configuration resembles that shown in the figure.



3. **Log in to the Oracle Fabric Interconnect 1 as** `admin`**.**

4. **Save your current I/O configuration:**

```
system export xgos-3.9.0.xml
```

Where `xgos-3.9.0.xml` is the existing configuration file.

5. **Disable the server profiles to both ESX Server hosts.**

```
set server-profile esx1 down
set server-profile esx2 down
```

Where `esx1` and `esx2` are the server profiles.

In the next several steps, you will upgrade the host drivers on ESX Server 1.

Note – When upgrading a VMware server, be aware of the particular versions of ESX server software, HCA firmware, and Xsigo host drivers required. Refer to the Release Notes for a list of the compatible host drivers.

Make sure to select the compatible pair of drivers. Using incompatible drivers can result in serious malfunction of your ESX Server.

---

6. **Copy the host driver package to your host.**

```
scp </path/to/driver.zip> user@host:/mydrive
```

The host driver package contains both the InfiniBand stack and the Xsigo host drivers

7. **Check the version of the drivers installed on the system.**

```
esxupdate query
---Bulletin ID----------  Installed----- --------------Summary-----
ESX410-Update01            2011-07-14T12:53:00   VMware ESX 4.1 Complete Update
XSIGO-4.1.0.260247.3.5.0-1 2011-07-19T09:31:18   Xsigo Systems Virtual Driver +
IB Bundle
```

8. **Remove the Xsigo drivers package:**

```
esxupdate remove -b <bulletin-ID>
```

Note – This process can take up to two minutes. Do not interrupt it

---

9. **Install the new Xsigo drivers package:**

```
esxupdate update --bundle <xsigo.zip>
```

10. **Confirm that the updated packages have been installed:**

```
esxupdate query
---Bulletin ID----------  Installed----- --------------Summary-----
ESX410-Update01            2011-07-14T12:53:00   VMware ESX 4.1 Complete Update
XSIGO-4.1.0.260247.3.9.2-1 2011-07-19T09:31:18   Xsigo Systems Virtual Driver +
IB Bundle
```

Note – Do not reboot the host server at this time. You must reboot for the new drivers to take effect but you must wait until the Fabric Interconnect is also upgraded. You will do that next.

---

11. **If you logged out, log in to the Oracle Fabric Interconnect as** `admin`**.**

12. **(Optional) If any other administrators are likely to be connected to your Oracle Fabric Interconnect, issue a system broadcast to warn them to disconnect:**

```
system broadcast Upgrading the Fabric Interconnect in 2 minutes!
```

13. **Issue the system upgrade command and supply the full path to the new system image.**

    or example, assume the following:

    - the new system image is named `xgos-3.9.2.xpf`
    - the new system image is on a server named “cairo” in the `xsigo/upgrades` directory:

```
system upgrade scp://root@cairo.xsigo.com/upgrades/xgos-3.9.2.xpf
```

    If you upgrade using SCP, you will be prompted for a password.

Note – If you get the this error message during the upgrade, `Installation failed (Unable to unpack package file xsigo-3.9.2.xpf,` issue the `system clear garbage` command to remove any partial or failed installs.

When you issue the `system upgrade` command, the Fabric Interconnect begins the upgrade. While the upgrade occurs, status messages are displayed, as shown in the following example:

```
Copying...############################################################ [100%]
You have begun to upgrade the system software.  Please be aware that this will
cause an I/O service interruption and the system may be rebooted.
The following software will be installed
 1. XgOS Operating System software including SCP Base OS
 2. XgOS Front-panel software
 3. XgOS Common Chassis Management software on IOC
 4. XgOS VNIC Manager and Agent software
 5. XgOS VN10G and VN10x1G Manager and Agent software
 6. XgOS VHBA and VHBA-2 Manager and Agent software
 7. XgOS VN10G and VN10x1G Manager and Agent software with Eth/IB Interfaces
 8. XgOS VHBA-3 Manager and Agent software
 9. XgOS VHBA 2x 8G FC Manager and Agent software
 10. HCA's Firmware and Option ROM
Are you sure you want to update the software (y/n)?y
Running verify scripts...
Running preunpack scripts...

Installing...       ################################################ [100%]
Verifying...        ################################################ [100%]
Running preinstall scripts...
The installer has determined that a cold restart of the Director is necessary
Installing package...
Running postinstall scripts...
```

At this point, the Fabric Interconnect will restart, and you will be logged out. Wait for a few minutes so that the Fabric Interconnect can complete its reboot, then log in. When the Fabric Interconnect is rebooting, reboot ESX Server 1.

The Fabric Interconnect will take approximately 2 minutes to reboot, but approximately 10 minutes for I/O cards, virtual resources, and all related services to come back up and restore service.

14. **Log in to Fabric Interconnect 1.**

15. **Wait for the I/O cards in the Fabric Interconnect to finish initializing before proceeding.**

    To determine whether the I/O cards are initialized, use the `show iocard` command. The Fabric Interconnect displays the state of all cards. When the state of the cards is `up/up`, you are ready to proceed.

```
slot   state  descr     type                              v-resources
-------------------------------------------------------------------
4      up/up            nwEthernet10Port1GbCard             0
```

```
6       up/up             nwEthernet10Port1GbCard          0
10      up/up             sanFc2Port8GbCard                2
12      up/up             nwEthernet1Port10GbCard          2
14      up/up             nwEthernet1Port10GbCard          0
15      up/up             nwEthernet10Port1GbCard          0
6 records displayed
```

16. **When the I/O cards all show** `up/up`**, check the state of the vNICs and vHBAs:**

```
show vnic *
show vhba *
```

The state of the vNICs and vHBAs should be `up/up`.

The Fabric Interconnect uses a hold time which pauses the vNICs and vHBAs for a window of time while the I/O cards come back online. This step checks to make sure that all the vNICs and vHBAs have reconnected after the I/O card has come up.

17. **Log in to the ESX server when all vNICs and vHBAs in the Fabric Interconnect have come to** `up/up` **state.**

18. **Verify that all the vNICs and vHBAs on the ESX server have reconnected and returned to Up or active state.**

    a. **For vNICs, type:**

```
esxcfg-nics -l
Name     PCI           Driver      Link Speed     Duplex MAC Address       MTU
Description
xnic0    0000:03:00.00 xsvnic      Up   1000Mbps  Full   00:13:97:02:51500
Broadcom Corporation Broadcom NetXtreme II BCM5709 1000Base-SX1:7e
xnic1   0000:04:00.00 xsvnic      Up   1000Mbps  Full   00:13:97:01:21:fe 1500
Mellanox Technologies MT26428 [ConnectX IB QDR, PCIe 2.0 5GT/s]
```

When the Link field is **Up**, the VNICs are connected.

b. For vHBAs, type:

```
esxcfg-mpath -l
fc.5001397100002505:5001397000002505-
fc.2001000b08002539:2400000b08043110-eui.00
0b080074002539
 Runtime Name: p3:C0:T0:L2
 Device: eui.000b080074002539
 Device Display Name:Pillar Fibre Channel Disk
(eui.000b080074002539)
 Adapter: p3 Channel: 0 Target: 0 LUN: 2
 Adapter Identifier: fc.5001397100002505:5001397000002505
 Target Identifier: fc.2001000b08002539:2400000b08043110
 Plugin: NMP
 State: active
  :
  :
```

When the `State` field shows **`active`**, the vHBA is up and connected.

19. Verify that the new software has been installed, type:

```
show system version
Build 3.6.0-XGOS  - (root) Thu Jul 21 23:39:53 UTC 2011
```

20. Enable the server profiles which you disabled in Step 5**:**

```
set server-profile esx1 up
set server-profile esx2 up
```

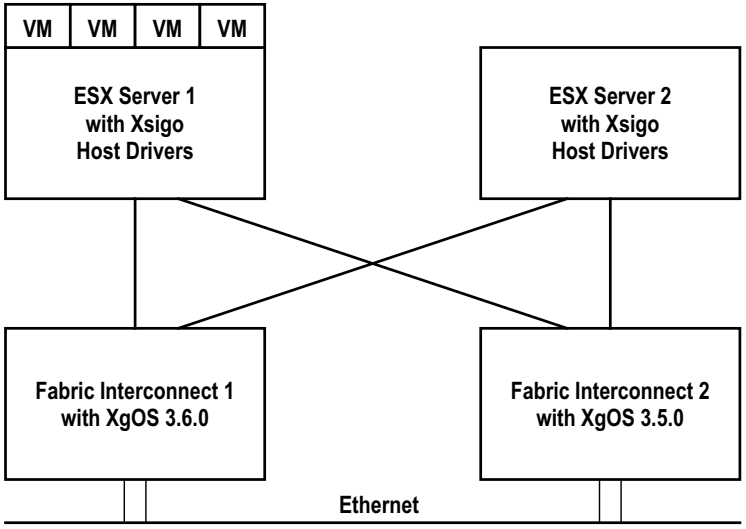
Proceed to "Upgrade Second ESX Server and Fabric Interconnect" on page 20-392 to upgrade ESX Server 2 and Fabric Interconnect 2.

▼ Upgrade Second ESX Server and Fabric Interconnect

1. Log in to ESX Server 2.

2. Use VMotion to move all guest machines off of ESX Server 2.

When you have finished, your system configuration resembles that shown in the figure.



3. **Log in to Fabric Interconnect 2 as** `admin`**.**

4. **Save your current I/O configuration:**

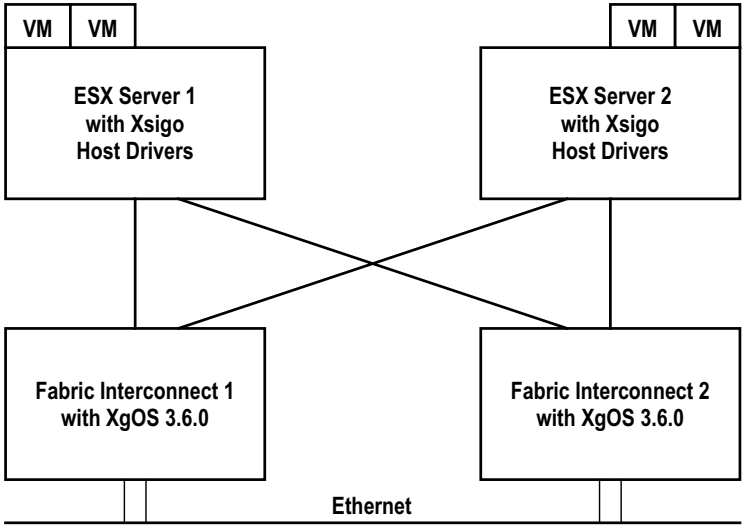
```
system export xgos-3.9.0.xml
```

   Where `xgos-3.9.0.xml` is the existing configuration file.

5. **Repeat Step 4 through Step 19 of the** "Upgrade First ESX Sever and Fabric Interconnect" on page 20-387**.**

6. **Use VMotion to restore your initial configuration.**

   Your system configuration should now resemble that shown in the figure.



Glossary

A

Active Directory Active Directory (AD) is an implementation of LDAP directory services by Microsoft for use primarily in Windows environments. Its main purpose is to provide central authentication and authorization services for Windows based computers. Active Directory also allows administrators to assign policies, deploy software, and apply critical updates to an organization.

Admin State Administrative state. The intention of the operator by setting a given resource up or down. See also *Oper State*.

C

CPIO Copy Input Output. A binary file archiver and a file format. CPIO's use by the RPM Package Manager continues to make CPIO an important archive format. See man page `cpio(1)`.

F

FC Fibre Channel. The American National Standards Institute (ANSI) began work on FC in 1988, and since then the X3T11 Task Group (see www.t11.org) has developed 20+ standards. FC has its own stack of protocol levels (layers), ranging from the physical connectors and media (FC-0) to

upper-level protocols (FC-4). Each of these levels defines a different and separate part of how the FC equipment communicates. The different FC-4 protocols (FCP, IP, Virtual Interface, and others) are tied directly to different kinds of applications (storage, networking, and clustering) for different uses. For more background information, see www.fibrechannel.org.

H

HA vNIC High Availability vNIC - A pair of virtual Ethernet interfaces that are both assigned to the same server profile, but bound to different physical interfaces.

HBA Host Bus Adaptor. A Fibre Channel network interface card used in a SAN fabric. *FC* HBAs are replacing *SCSI* HBAs.

HCA Host Channel Adapter. An InfiniBand network interface card used in an InfiniBand network. An HCA provides high-speed connectivity and virtual interfaces, based on the InfiniBand interface. An HCA can have 1 or 2 ports.

hypervisor A hypervisor is a virtualization platform that allows multiple guest operating systems to run at the second level above the hardware.

I

IB InfiniBand. A switched fabric communications link primarily used in high-performance computing. IB is the result of merging two competing designs, Future I/O, developed by Compaq, IBM, and Hewlett-Packard, with Next Generation I/O (ngio), developed by Intel, Microsoft, and Oracle. For more information, see www.infinibandta.org.

IDE Integrated Drive Electronics. Throughout the 1980s, a standard interface for connecting hosts to direct-attached storage devices. Parallel *SCSI* was another approach.

I/O Input/Output. In computer architecture, the combination of the CPU and main memory (i.e., memory that the CPU can read and write to directly, with individual instructions) is considered the heart of a computer. Any movement of information to or from that complex, for example to or from a disk drive, is considered I/O.

I/O Module A physical card that is installed in one of 15 slots in the chassis' card bay. There are two types of I/O module: Ethernet and Host Bus Adapter. The Ethernet and Host Bus Adapter modules provide access to Ethernet and Fibre Channel networks, respectively.

I/O Port A single port on an Ethernet module, a Host Bus Adapter module, or one of the 24 InfiniBand server ports.

J

JBOD Just A Bunch of Disks. Very large storage arrays, capable of storing terabytes and terabytes of data. Farms of JBODs connect through an *FC SAN*. In a JBOD each disk is visible to the SAN, assigned an address, and is treated as an autonomous device even though the physical disks are located in the same enclosure.

jitter For QoS the delta between packets on the receive side. Low jitter is guaranteed by having a low-latency queue mechanism. In this way, a flow is guaranteed service and packets are not held up (delayed) in buffers.

K

Kerberos Kerberos is a network authentication protocol. It is designed to provide strong authentication for client/server applications by using secret-key cryptography. Kerberos was developed in the Athena Project at the Massachusetts Institute of Technology (MIT). The name is taken from Greek mythology; Kerberos was a three-headed dog who guarded the gates of Hades. Kerberos lets a user request an encrypted "ticket" from an authentication process that can then be used to request a particular service from a server.

L

LDAP The Lightweight Directory Access Protocol (LDAP) is an application protocol for querying and modifying directory services running over TCP/IP. A client starts an LDAP session by connecting to an LDAP server, by default on TCP port 389. The client then sends operation requests to the server, and the server sends responses in turn.

M

Managed Object An object-oriented representation of a resource managed in a device. This can be a physical or logical resource.

N

NAS Network Attached Storage. NAS uses common client networks, such as Ethernet, to connect client computers to a host file server. Unlike *SAN*s, the client does not directly communicate with the storage. Data exchange occurs at the file level, unlike a SAN where data is operated at the block level over *FC*.

NPIV N-Port ID Virtualization, a fibre-channel facility that allows multiple node port IDs to share a single physical node port.

O

OFED OpenFabrics Enterprise Distribution. OFED is the driver stack for the InfiniBand Host Channel Adaptor (HCA). For more information, see http://www.openfabrics.org

OpenSM The default Subnet Manager running on the Oracle Fabric Interconnect.

Oper State Operative state. This indicates whether a resources is configured and operating properly. See also *Admin State*.

OVN Oracle Virtual Networking. Oracle Virtual Networking products virtualize SAN and LAN infrastructure.

P

Policy Configuration of automatic system behavior (e.g. stats collection, dB cleanup, etc.).

Q

Quality of Service The Quality of Service (QoS) object allows the data traffic of individual applications or interfaces to be managed. The performance of a particular application can be guaranteed by raising the priority of its dataflow, relative to the other applications.

R

RADIUS Remote Authentication Dial In User Service (RADIUS) is an Authentication, Authorization, and Accounting (AAA) protocol for controlling access to network resources. RADIUS is commonly used by ISPs and corporations managing access to Internet or internal networks across an array of access technologies including modem, DSL, wireless, and VPNs.

RAID Redundant Array of Inexpensive Disks.

RDMA Remote Direct Memory Access. One of the key problems with server I/O is the CPU overhead associated with data movement between memory and I/O devices, such as LAN and SAN interfaces. InfiniBand solves this problem by using RDMA to offload data movement from the server CPU to the InfiniBand HCA. Using RDMA, the sending device either reads data from or writes data to the target devices' user space memory, thereby avoiding CPU interrupts and multiple data copies on the memory bus. This approach enables RDMA to significantly reduce the CPU overhead associated with data movement between nodes.

Role One of 5 fixed-privilege levels that a user may be assigned (such as, Operators, Administrators, or Storage).

S

SAN Fibre Channel Storage Area Network. A SAN is a network of storage and system components, all communicating on a fibre-channel network, that can be used to consolidate and share storage, provide high-performance links to data devices, add redundant links to storage systems, speed up data backup, and support high-availability clustering systems. The advent of SANs has been driven by today's insatiable appetite for storage. See www.snia.org for more background information.

SCSI Small Computer Systems Interface. In the early 1980s, SCSI was the standard direct-attach storage interface to SCSI-enabled disks. As computer systems increased in speed and data storage needs increased, the parallel bus architecture of SCSI began hitting performance and distance limits. In response to this need, *FC* was introduced to provide gigabit-speed serial networking capabilities for storage.

Server Profile One instance of a server I/O configuration that is assignable to a single physical server through an IB port.

State Displayed in Oracle Fabric Manager and the CLI as a pair of statuses, for example: up/up. The first is the *Admin State* while the second is the *Oper State*. When using SNMP or the Java Apes, these statuses are returned individually.

T

TSO TCP Segmentation Offload (also called large segmentation offload, or LSO).

U

User An internal or external representation of a person. Users either exist locally or remotely via LDAP, Active Directory, or RADIUS. By default, an “admin” user is created locally.

V

vHBA Virtual Host Bus Adapter - A Fibre Channel Storage connection, provided without a physical HBA.

VLAN Virtual Local Area Network - A private, independent, logical networks that are created within a physical network. A VLAN behaves like an ordinary LAN, but connected devices don’t have to be physically connected to the same network segment.

VM Virtual Machine. A VM is a software entity that runs its own operating systems and applications, as if it were a physical computer. A VM behaves exactly like a physical computer and contains its own virtual (software based) CPU, RAM, hard disk, and NIC. An operating system installed on a VM is called a guest operating system.

vNIC Virtual Network Interface Card - An Ethernet interface, provided without a physical NIC.

W

WWNN World Wide Node Name

WWPN World Wide Port Name

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